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What Will You Do If You Can't Get Cars?

That Situation is Quite Probable With Dealers Who Do Not Make Early Arrangements for Territory

Never in the history of the world has there been so much money in circulation as there will be during the next twelve months.

The government program calls for a monthly expenditure exceeding a billion dollars. An appropriation of two hundred million dollars for railroad equipment is planned. Investors are to be guaranteed returns on their holdings. Farmers know there will be a certain and profitable market for all they can produce. There is evidence that wages are to be increased—in some lines the discussion mentions as much as 40 per cent.

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Fifty thousand Super-Sixes, more built than of any other fine car, have been sold during the past two years. You can see how inadequate the number available this year will be.

We are merely meeting the minimum needs of our Distributors. They will first of all take care of their most loyal dealers. The eleventh-hour contractors may find it too late to arrange for deliveries.

Delayed decision on your part may deprive you of cars this year.

HUDSON SUPER SIX TRADE MARK REG.

HUDSON MOTOR CAR CO.

Detroit, Michigan

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HEATER

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Protector Shield Stays Cool Enough to Touch So It Cannot Burn Shoes or Robes

—manufacturers

It is as much a duty to equip your cars that are to be used in winter with a UTILITY Protected Foot Rail Heater as it is the duty of the contractor to specify a heating system in your home, factory or office.

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HILL PUMP VALVE CO. UTILITY CHICAGO U.S.A.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XXXVIII NEW YORK—THURSDAY, JANUARY 24, 1918—CHICAGO No. 4

Late Exemption Notices

Delay Production of War Orders

Many Firms Closed Friday and Saturday But Opened Monday—War Truck Factories Not Exempted—Illinois Tractor Makers Exempted But Wisconsin Not Exempt—Airplane Work Halted Friday and Saturday—Automobile Production Stopped—Dealers and Service Stations Closed

NEW YORK CITY, Jan. 23—While the entire automotive industry displayed an excellent spirit of patriotism in almost universally obeying the letter of the Fuel Administrator order closing factories for 5 days, there has been very general criticism in the way the order was carried out.

Unfortunately, exemption notices were not well timed, and great numbers of factories engaged in the manufacture of airplane engines and parts were closed all day Friday and all day Saturday, because the exemption notices did not reach them until late Friday night and it was impossible to get the working forces of the factories together for Saturday.

This was particularly true in such centers as Detroit, Cleveland, Indianapolis, Toledo and Flint. For example, Ford, which is one of the largest manufacturers of war parts, was closed down Friday, and practically closed all day Saturday. The injury and delay of such a closing down affected not only the Ford plant but others making aircraft parts for the reason that Ford supplies the cylinders for many makers.

Due to lack of proper notification with regard to exemptions, the tractor industry in Illinois and in Wisconsin suffered seriously. Many tractor makers received their exemption notices in time to begin work Saturday, but their factories had closed on Friday. In Wisconsin the J. I. Case Co., one of the largest tractor makers, was closed down completely and in all probability will have to remain closed during the 5 days as the Wisconsin State Fuel Administrator did not exempt the factories the same as did the Illinois administrator. In Minnesota the tractor interests were closed by the Fuel Administrator's orders.

One way in which the exemptions issued by the Fuel Administrator failed to carry was in connection with those firms manufacturing parts for the standardized war trucks of the Quartermaster's Depart-

ment. While makers of aircraft parts and tractor parts received exemptions none were received by the makers of engines, axles and other parts for the war trucks.

In Milwaukee the shut-up of industries is almost complete, only five or six out of 2300 industries remaining in operation; even the Wisconsin Motor Mfg. Co., which is working on government work almost exclusively, received its exemption from the War Department too late and it was closed Friday and Saturday, but renewed work Monday morning.

In Cleveland, the closing up situation was made worse by the fact that the street railway company was put on a Sunday schedule, so that thousands of workers were hours late in reaching the factories that had been given permission to work.

Many factories engaged on government work were not given exemption notices in time, and they were closed during Friday and Saturday. Peerless, which is making 10 trucks a day for the British government, was closed during the 5-day shut-down. Stearns, engaged on aviation engine parts, did not receive its permission to go ahead until Tuesday, so that it virtually lost all 5 days. Standard Parts has only half its men at work, although it is on government orders. The Marvel Accessories Co., working on airplane parts, could not receive an exemption, although it wired for one; it shut down for 5 days and used the time to install machinery.

Manufacturing in Indianapolis was practically suspended by the rule, and on Monday only one or two concerns were exempted. Nordyke & Marmon got an exemption order on its aviation work only. Premier, which is manufacturing F. W. D. trucks, was also exempt. All other factories were closed.

The Detroit situation was very serious. Ford laid off 35,000 men; Packard 8000; Cadillac 6000; Hupmobile 12,000; Continental 3000, and Timken 5000.

The greatest criticism from Detroit was that the exemption lists did not come with the order to shut down. The order was issued so late Wednesday night in Washington that the morning papers were not able to carry it as were the daily papers in the eastern section of the country. Detroit feels that the economy of coal is not at all commensurate with the loss to the industry by the shutting down order of the Fuel Administrator.

Fuel Order Closed 90% of Detroit's Plants

More than 200,000 Men Temporarily Out of Work—Comparatively Little Coal Saved by Shut Down

DETROIT, Jan. 19.—One bitter thought overspreads all others in connection with the effect of the fuel edict throughout Michigan, Ohio, and the Middle Western territory. This is, that in spite of the hundreds of thousands of men thrown temporarily out of work, in spite of industries temporarily paralyzed, very little fuel is really being saved. It is necessary to heat the plants to save them from destruction by freezing, and this takes a large percentage of the coal ordinarily consumed. In some of the big plants not over 10 tons a day are being saved by the order.

The general attitude of manufacturers is expressed in the words, "As patriotic citizens we must obey the edict of the government regardless of our personal opinions." The factories at once closed down, some of them operating a short time Friday until the order was recognized as being authoritative. Friday night telegrams were sent out to plants engaged on war contracts, but these were received too late in most instances, with the result that many had a hard time getting their organizations together Saturday to go on with the work.

Plants like Packard, Ford, Cadillac, Fisher Body, General Aluminum & Brass, Detroit Copper & Brass Rolling Mills, and the American Car & Foundry Co. were included in the exemptions announced by the Fuel Administration in Washington late Friday. All of these companies have one or more departments on important war work, and these departments alone are in operation today. There are others, however, doing war work which were still closed in all departments this morning. These included local plants working on parts for the Liberty trucks, such as Continental and Timken.

About 75 per cent of Detroit industries were shut down Friday, and on Saturday morning virtually 90 per cent of the city's industries adjusted themselves to the schedule imposed by the Fuel Administrator.

In accordance with the protest meeting held at the Board of Commerce Thursday afternoon, about forty shops, employing large numbers of men, went to work as usual Friday morning, but when an order was sent out by Governor Sleeper declaring that it was unpatriotic to disobey the edict, and that the State would enforce it, these also fell in line.

The greatest confusion is being caused by the delay in announcing exemptions. Many of those engaged in different branches of war work are expecting their exemptions hourly, but cannot afford to pay their organizations and hold them at the plants in anticipation of these orders. It was not until very late Friday afternoon that the fuel administration admitted officially that important war work is not affected by the order, and gave out a list of hundreds of factories that may continue work on government contracts only during the 5-day period.

Local factories engaged in war work telegraphed the fuel administration offices in Washington and also to the Washington representatives, when they had them, asking for definite rulings on these war contracts, with the result that the exemption list was hurried to some extent. Automotive products covered in the plants exempted in a list prepared by Secretaries Baker and Daniels included aircraft and aircraft parts, Signal Corps equipment, electrical supplies, and certain steelwork. The army trucks were not mentioned, although word is being expected on them any minute.

Willys-Overland closed except in the departments doing government work. The Elmira plant is running night and day, and the Elyria plant is also going ahead with its airplane work. The number of men laid off by the Willys-Overland Co. is 8000. The coal saving of this company amounts to about 200 tons a day.

Practically the same conditions apply to Buick, where all but the aircraft men are laid off, making a total of

about 12,000 employees out of work for the 5-day period. This company uses normally 600 tons of coal a day, of which 42 per cent will be saved through closing. The general coal situation in Flint is probably as bad as it is anywhere in the country. There are 4000 families practically without coal, and there is no coal anywhere near the city, and no cars en route. The schools have been closed for a week and the coal taken from the cellars and placed into the bins of private users. This company has voluntarily reduced its production by closing its plant over a week ago to conserve fuel to meet the serious situation obtaining in Flint.

Ford started Monday operating in the departments where government work is under way, the most important of this being the department concerned with the manufacture of cylinders for the Liberty aircraft engines. This highly important work was closed down with the rest of the factory because the Ford company did not get its exemption order until late Friday night, when it was too late to get the force together to start work again Saturday. In saving of coal the 5-day shutdown of the Ford company will mean about 60 carloads, or 12 carloads a day. The normal consumption is from 17 to 18 carloads per day.

The number of men thrown out of employment in Detroit alone is approximately 200,000. These men will not be paid during the layoff period, so far as is known by any of the companies, although one or two still have the matter under consideration. To give an idea of the number of men affected by the order, the Ford company has laid off temporarily 35,000 men, Willys-Overland 8000, Buick 12,000, Studebaker Detroit plant 3000, Continental 3000, Cadillac 6000, Packard 8000, Timken (both plants) 5000, and Hupmobile 12,000.

Some of the companies making motors and feeding back the power developed by these motors on test back into the lines really lose coal instead of gaining it by the closing order. A rough estimate of the coal saved by some concerns is: Hupp Motor, 10 tons a day; Packard, 35 tons a day; Studebaker, 150 tons a day; Timken, 100; Buick, 250; and Willys-Overland, 200. Figures from other companies are not available.

Illinois Tractor Makers Escape Shut Down

CHICAGO, Jan. 19.—The tractor industry in Illinois is the only portion of the motor industry where manufacture is not greatly restricted in this territory by the heatless-day order. According to an exemption ruling to-day, manufacturers of farm implements and agricultural tractors in the State are permitted to operate without interruption during the remainder of the five fuelless days and on the fuelless Mondays, as long as production is confined to orders for spring delivery.

Inasmuch as all of the more important tractor makers in the State have orders for spring delivery far ahead, the new ruling will permit them to resume operations, which have been suspended since yesterday.

So far as known now, tractor makers in other States are not so fortunate. In Wisconsin, the State fuel administrator has not exempted the implement and tractor men. The J. I. Case T. M. Co., Racine, Wis., one of the biggest farm implement and tractor manufacturers, as well as being a car builder, has closed down completely so far as work inside the plant is concerned, and will remain so till Wednesday, and on the following nine Mondays, unless a ruling is received to the contrary.

The instance of the Case T. M. Company is typical of larger concerns in many industries. This concern, though it is not making anything directly for our Government, is making the machines which increase the production of foodstuffs. Also it is making thousands of tractors for our Allies. At this time it is sending 700 carloads of tractors to Europe. Its 4500 men are idle, except those that can be used in clearing away snow and loading and unloading cars on its sidings.

Car and truck manufacturers who are not doing any government war business are shut up completely. Most of the concerns in this territory, however, are doing some Government work on war materials, trucks particularly, and are operating those portions of their plants devoted to the production of war orders. The remainder of their plants are closed. The Nash Motors Co., which is making war trucks, is operating the part of the plant solely devoted to U. S. orders, and has closed the rest. Velie is doing likewise, though 800 of its 1200 men will be idle during all of the heatless days. Root & Vandervoort, Moline, makers of the Moline-Knight, are devoting 85 per cent. of their facilities to war work, yet are closed down completely, and will remain so throughout the heatless days, unless they receive exemption orders.

Mitchell and Studebaker are closed to-day, and whether they remain so will depend upon rulings of the national or State fuel administrators. Both are working on government contracts.

One Milwaukee Plant Exempt

MILWAUKEE, WIS., Jan. 21—With the exception of the Wisconsin Motor Mfg. Co., every passenger and commercial car engine and parts factory in Milwaukee and vicinity was entirely closed for 5 days, throwing more than 7500 men out of employment. The Wisconsin Motor Co. closed with others Friday, but later received permission from the War Department to resume Monday morning to hasten Liberty engine production. Only five or six out of 2300 industries are in operation. All garages closed tight Monday. The loss of wages of 100,000 workmen is regarded as the worst result. The order is generally characterized as too arbitrary, considering peculiar local conditions, and hardly justified. No instances of violation are reported. The general effect is rather depressing.

Here, as in other cities, the exemption orders were received in many cases too late to permit the various factories to take proper advantage of them.

Indianapolis Industry Suspends

INDIANAPOLIS, Jan. 21—Industry in this city and central Indiana is all but suspended as a result of the enforcement of the federal Fuel Administrator's five days' closing. The Premier Motor Corp., which is manufacturing motor trucks for army use, is the only plant that has been in operation to-day, this company having received word from Washington Saturday to continue in operation.

Nordyke & Marmon, which is manufacturing airplane engines and milling machines in addition to automobiles, was the first company in the city receiving orders from the Fuel Administration to continue operations, but the order related solely to a continuance of the aviation and milling machinery departments.

The plants of the Cole Motor Car Co., the Stutz Motor Car Co., the National Motor Car & Vehicle Corp. and the Empire Automobile Co. have been closed, only enough heat being provided to keep automatic sprinkler systems from

freezing. All automobile plants in central Indiana that are not engaged in manufacturing supplies for the Aviation Department, or which are not making trucks, are not in operation.

Officials of the companies, although realizing that they have been compelled to sustain a serious loss, are not complaining over the order, although its issuance is universally condemned. The chief difficulty from the Fuel Administration's act is expected to be increased freight congestion, which, it is believed, will embarrass the motor industries considerably within the next few weeks.

Cleveland Shut Up Tight

CLEVELAND, OHIO, Jan. 22—Cleveland has been shut down tighter than may have been anticipated even by Fuel Administrator Garfield. When the shutting down process began the interdependence of industries asserted itself in a striking manner and the shutdown became tighter than was intended.

In this situation the street car company played an important part. On Monday it put on what it said was a Sunday schedule, it not having been directed to do otherwise. The result was that schools were an hour late in opening, thousands of workers were late in arriving at shops that had permission to keep open, and the public arrived at an almost riotous frame of mind as the packed street cars filed by without stopping. At one corner the crowd pulled the trolley pole off and forced its way aboard.

During this trying period motor cars and trucks came partially to the rescue. Taxicab companies did yeoman service.

Some shops with government work could get no reply from Washington or elsewhere, so shut down. In some cases exemptions arrived too late to be of value. The city determined to live up to the order unless explicitly instructed to the contrary, and the result was a shutdown tighter even than a normal Sunday.

Peerless, which is making 10 trucks a day for the British Government, is closed tight for the five days. Even its offices were closed Monday.

White closed Friday and Saturday, but opened up on government work Monday when an exemption was received. Chandler is closed tight and has moved part of its offices to parlors in the Hollenden Hotel.

Winton has government work on lighting sets, but is shut for the five days because it could get no order to the contrary. It expects to keep its offices open Mondays hereafter if possible.

Stearns is almost entirely shut down for the five days. To-day it got permission to work on its airplane parts contracts. It is hauling coal on trucks to keep open.

The Warner & Swasey Co., which is making gun fire control instruments, is working a third of its men. One thousand are out of work. Its exemption was not received until Friday. It uses 15 to 20 tons of coal a day and has about 100 tons on hand.

The Standard Parts Co., which is making truck and airplane parts, has from 800 to 1000 men out of work. It has about 1500 employees.

The Marvel Accessories Co., whose shop is making airplane parts, sent a 92-word letter to Fuel Administrator Garfield, but got no reply, and is using the five-day period to install additional machinery. A few of the factories have supplies of coal. Many are working from day to day.

Newspapers in this section state to-day that the five-day shutdown seems to have done little good so far as getting coal to Ohio's industries is concerned. The same applies to coal for home consumption. Most of the factories are not paying their men for the lost days and not many see any chance of regaining the lost time.

The public attitude is that the order should be obeyed first and talked about afterward. There is also a feeling that the public should be let to know a little more of the inside situation when such drastic measures are stated to be necessary. A strong sentiment seems to be rising in favor of a shutdown in passenger traffic if such would help the situation. This was recommended Monday by Hugh Chalmers at a meeting of Ohio dealers.

A continuance of winter weather has been a handicap.

Minneapolis Hard Hit

MINNEAPOLIS, Jan. 21—Automobile, tractor and accessory factories closed five days in Minnesota with few exemptions and tire and repair shops and oil stations to-day, in addition to smaller automobile factories at St. Cloud, Luverne and Duluth. In Twin Cities closures are as follows: Ford Motor Co., 600 men; H. E. Wilcox Motor Co., 300; Wilcox-Bennett Carbureter Co., 100; Pence Automobile Co., 200; Maxwell branch, 40; Chevrolet and Willys-Overland, small forces.

Tractor companies in cities and suburbs have about 4000 men, of which perhaps 1700 are exempt, including employees of Minneapolis Steel & Machinery Co. and Emerson-Brantingham Co.

Repair shop and oil stations are allowed to do emergency work. About 200 oil station men and 150 tire repair men are out and 2000 repair shop employees. The automobile industries seem to regard the day as a regular holiday, but tractor companies regret setback on their seasonable product, requiring one extra day to get cold shops working again. This applies also to tractor accessories, on production of which output of finished tractors depends.

Kansas City Little Affected

KANSAS CITY, MO., Jan. 21—No manufacturing industries are closed here so far by the Fuel Administration order.

The Fuel Administrators of Kansas, Missouri, Arkansas, Oklahoma, Nesbraska and Iowa are in conference to-day in Kansas City. All say that in these states all industries apparently can be taken care of, but amusements, saloons, office buildings and retail stores are being restricted.

Partial List of Companies Exempted

FOLLOWING is one of the early and partial lists, showing some of the concerns which have been exempted from the Fuel Administrator's order:

For the Manufacture of Aircraft and Signal Corps Products:

A. C. Clark Co.	Chicago
Packard Motor Co.	Detroit
Ford Motor Co.	Detroit
Lincoln Motor Co.	Detroit
Trego Motors Corpn.	New Haven
Nordyke & Marmon Co.	Indianapolis
Union Switch & Signal Co.	Swissvale, Penn.
Pittsburgh Model Engine Co.	Pittsburgh
Willys-Overland Co.	Toledo
Wright Martin Aircraft Corpn.	New Brunswick
Aeronautical Engineering Co.	Long Island City
General Motors Corp.	Detroit
Curtiss Aeroplane and Motors Corp.	Buffalo
Thomas Morse Aircraft Corp.	Ithaca
Fisher Body Corp.	Detroit
Dayton Wright Airplane Co.	Dayton
Standard Aeroplane Corp.	Elizabeth
Cutler Desk Co.	Buffalo
Rubay Co.	Cleveland
Engel Aircraft Co.	Niles, Ohio
Lewis Spring and Axle Co.	Chelsea, Mass.
W. H. Mullins Co.	Salem, Ohio
National Gauge and Equipment Co.	La Crosse, Wis.
U. S. Gauge Co.	Sellersville, Penn.
Julius King Optical Co.	New York City
Taylor Instrument Co.	Rochester
National Cash Register Co.	Dayton
Sperry Gyroscope Co.	Brooklyn, N. Y.
American Radio and Research Corp.	New York City
American Steel and Wire Co.	Trenton
Bausch & Lomb Optical Co.	Rochester
Hartzell Walnut Propeller Co.	Piqua, Ohio
West Woodworking Co.	Chicago

Flottorp Mfg. Co.....Chicago
John A. Roebling Sons Co.....Trenton
Western Electric Co.....New York City
Western Elect. Instrument Co.....Newark
Eastman Kodak Co.....Rochester
Splitdorf Elec. Co.....Newark
Wyman Gordon Co.....Worcester, Mass.
American Propeller Co.....Baltimore
Astoria Veneer Mill & Dock Co.....Long Island City, N. Y.

For the manufacture of emergency navy contracts:

Curtiss Engineering Corp.....Garden City, N. Y.
L. W. F. Engineering Co.....College Point, N. Y.
Aeromarine Plane & Motor Co.....Keyport, N. Y.
The Burgess Co.....Marblehead, Mass.

For the manufacture of products for Shipping Board:

General Electric Co.....Erie, Penn.
General Electric Co.....Schenectady
General Electric Co.....Lynn, Mass.

For emergency fleet orders and emergency Government work:

Bethlehem Steel Co.....Steelton, Penn.
Bethlehem Steel Co. .....S. Bethlehem
Bethlehem Steel Co.....Sparrows Point
Midvale Steel & Ordnance Co.....Nicetown, Penn.
Midvale Steel & Ordnance Co.....Coatesville, Penn.
Midvale Steel & Ordnance Co.....Johnstown, Penn.
Lukens Steel Co.....Coatesville, Penn.
Carnegie Steel Co.....Pittsburgh
Crucible Steel Co.....Pittsburgh
Crucible Steel Co.....Harrison, N. J.
La Belle Iron Works.....Steubenville, Ohio
Otis Steel Co.....Cleveland
Lackawanna Steel Co.....Buffalo
Illinois Steel Co.....Chicago
Jones & Laughlin Steel Co.....Pittsburgh
Donner Steel Co.....Buffalo
Inland Steel Co.....Indiana Harbor, Ind.
Central Steel & Iron Co.....Harrisburg
Republic Iron & Steel Co.....Youngstown
Brier Hill Steel Co.....Youngstown
Corrigan, McKinney & Co.....Cleveland
Forged Steel Wheel Co.....Butler, Penn.
Whittaker-Glassner Co.....Portsmouth, Ohio
Youngstown Sheet & Tube Co.....Youngstown, Ohio
Alan Wood Iron & Steel Co.....Conshohocken, Penn.

For the manufacture of "gas masks of the box respirator type":

B. F. Goodrich Co.....Akron
Goodyear Tire & Rubber Co.....Akron
Mechanical Rubber Goods Co.....Cleveland
C. Kenyon .....Brooklyn
Nashawanna Mill .....New Bedford, Mass.
Wamsutta Mill .....New Bedford, Mass.
Sayles Bleacheries.....Saylesville, R. I.
Hero Mfg. Co.....Philadelphia

For the manufacture of important forgings:

Bethlehem Steel Co.....South Bethlehem
Midvale Steel Co.....Nicetown, Penn.
Hydraulic Pressed Steel Co.....Cleveland
American Car and Foundry Co.....Detroit

Forgings for Destroyers:

Allis-Chalmers .....Milwaukee
Camden Forge Co.....Camden, N. J.
Erie Forge Company.....Erie

Miscellaneous:

Detroit Gear & Mch. Co.....Detroit
McCord Mfg. Co.....Detroit

Urge Permanent Highways Paralleling Railroads

Highways Industries Association Fosters Movement to Supplement Usefulness of Rail Carriers

CHICAGO, Jan. 21.—By telegram.—At the organization to-day of the Highways Industries Association, an organization which gives promise of much activity, the consensus of opinion was that this country must build and maintain permanent highways alongside of and paralleling our main trunk railroad lines, so as to supplement the movement of freight and passengers by the railroads with the transportation of these by automobiles and motor trucks.

To do this, superefforts must be made to connect up the disjointed sections of such highway systems as are in existence, and our road activities should be along such a national line rather than along a promiscuous, disjointed system of building in different States secondary highways which are not of primary importance during the war.

The main object to-day is to build and maintain these national systems of highways, which would preferably parallel our main trunk lines, as these, in the majority of cases, are the necessary channels of transportation.

One of the points of greatest interest brought out at the meeting was the announcement by James I. Blakeslee, fourth assistant postmaster general, who is in charge of the rural postal system, that if plans work out as expected there will be motor-truck parcel post within a short time under operation by the Government between all principal points.

One complete system which will be in operation within the next 60 days, according to these plans, is a route between Chicago, Indianapolis, Louisville, Nashville, Chattanooga and Atlanta, connecting with a similar route between Portland, Me., and New Orleans.

Organization of the Highway Industries Committee was one of national importance, as it brought together representatives from the Government as well as road machinery and material concerns with highway organizations, and State highway officials of the country. Over 150 delegates who were present represented 1500 plants with a combined capital of $4,000,000.

The objects of the organization, as outlined in the call to the meeting are:

To assist co-operation with all governmental agencies, both State and national.

The co-ordination of the highways with other transportation agencies of the country.

To encourage the development of highways that will advance the economic life of the nation and stimulate their use in such manner as to facilitate and cheapen the transportation of food, raw materials and finished products, to the end that our highways may be of maximum service in the transportation of the nation.

S. M. Williams of the Gramm-Bernstein Company, Lima, Ohio, was elected president; A. R. Hurst, Wisconsin State Commissioner of Highways, first vice-president; Leon Gardiner, New York, second vice-president; and S. T. Henry, Washington, D. C., third vice-president.

Secretary and treasurer are to be appointed by the directors. Headquarters will probably be in Chicago or Cleveland.

Crude Oil Production Increased 29%

Increase from Wells 196,905 Barrels Per Day Over Output During 1916—Daily Capacity Now 1,085,455 Barrels

WASHINGTON, D. C., Jan. 23.—From official figures given out by the Bureau of Mines, the supply of crude oil for the calendar year of 1917 increased 29 per cent over that of 1916. This meant a daily increase of crude from the wells of 196,905 barrels. The daily averages for the 2 years are:

	Bbls.
1916 Daily average.....	674,849
1917 " " (first 6 mos.).....	796,106
1917 " " (last 3 mos.).....	871,774

These are reassuring figures in spite of the fact that there has been a scarcity of certain tiling or tubing for new wells, and in some places a shortage of labor for the sinking of wells.

While the production of crude has shown a great increase, there has been a growing on the storage supply of manufactured gasoline, and between June 30 and Sept. 30, a 3-months' period, the stored stock of gasoline was drawn on to the extent of 77,217,782 gal. While the supply of gasoline was thus drawn upon the supply of kerosene on hand increased during this period to practically the same extent, the exact gain being 68,493,824 gal.

The report from the Bureau of Mines shows that on Sept. 30 there were 234 refineries in active operation with a combined daily capacity of 1,085,455 barrels.

In the period between June 30 and Sept. 30 the difference in the amount of stocks of crude oil on hand at the refineries was caused by 11,000,000 barrels of pipe-line stocks being reported as refinery stocks on June 30, but not so repo rted Sept. 30.

The tabulation herewith shows the stocks on hand at the different refineries on July 31, Aug. 31, and Sept. 30 and June 30.

The outputs of the different refineries for the first 6 months of 1917 show a daily average of gasoline of 6,763,-457 gal. The total output of gasoline during the period was 1,224,182,157 gal.

The daily average of kerosene during the same period was 4,333,764 gal. Total kerosene production for the first 6 months was 784,411,291.

STOCKS ON HAND AT THE REFINERIES

	1917			
	July 31	Aug. 31	Sept. 30	June 30
Crude Oil (bbl.)...	10,866,357	10,811,355	10,925,892	24,183,830
Oils purchased to be Rerun (bbl.)..	1,618,821	1,640,861	1,878,512	———
Gasoline (gal.)...	345,199,195	298,548,699	287,758,562	364,976,344
Kerosene (gal.)...	516,752,342	511,639,188	508,461,071	438,967,247
Gas & Fuel (gal.).	596,865,830	602,779,662	633,216,982	716,427,186
Lubricating (gal.).	117,461,820	115,392,209	109,528,770	———

PRODUCTION OF CRUDE AND DISTILLATES

	1917 First 6 Months		1916 12 Months	
	Total	Daily Average	Total	Daily Average
Crude Oil Run (bbl.—42 gal.)..	144,095,162	796,106	246,992,015	674,842
Gasoline (gal.)...	1,224,182,157	6,763,437	2,058,880,596	5,625,357
Kerosene (gal.)..	784,411,291	4,333,764	1,455,495,732	3,976,764
Gas & Fuel (gal.).	2,724,646,700	15,053,297	4,663,895,284	12,742,883
Lubricating (gal.)	350,358,041	1,935,680	624,541,195	1,706,397
Wax lb.).....	203,975,713	1,126,938	386,180,898	1,055,139
Coke (tons).....	229,723	1,269	405,319	1,107
Asphaltum (tons)	320,805	1,772	716,490	1,958
Miscellan's (gal.).	139,467,183	770,537	239,244,468	653,673
Losses (bbl.).....	5,211,839	28,795	10,008,517	27,346

OUTPUT OF REFINERIES IN THE UNITED STATES BY MONTHS

1917	January	February	March	April	May	June	July	August	September	Total
Crude Run (bbl.).....	23,157,349	21,570,486	24,460,800	24,410,623	25,707,420	24,788,484	26,064,350	27,269,383	26,867,024	224,295,919
Oils Purchased and Rerun (bbl.).....	———	———	———	———	———	———	2,435,533	2,376,580	2,632,988	7,445,101
Gasoline (gal.).....	189,169,526	172,704,579	203,677,089	213,131,665	225,655,440	219,843,859	238,309,073	249,365,562	250,348,628	1,962,205,420
Kerosene (gal.).....	120,735,586	113,369,304	141,123,626	140,594,030	132,850,318	135,738,427	157,259,832	145,678,500	138,769,343	1,226,118,966
Gas & F. (gal.).....	443,955,903	424,115,567	467,378,504	439,724,364	481,281,431	468,190,931	585,932,568	620,029,660	618,067,279	4,548,676,207
Lube (gal).....	57,954,874	51,831,577	60,848,934	59,546,525	62,247,738	57,928,393	62,307,742	62,347,947	58,686,398	533,700,128
Wax (lb,).....	34,084,178	31,439,730	35,105,016	35,267,563	34,318,668	33,760,558	36,548,059	38,832,339	37,440,127	316,796,738
Coke (ton).....	37,622	35,672	41,968	40,084	37,919	36,458	39,814	43,787	40,101	353,425
Asph. (ton).....	48,860	39,795	51,265	50,404	63,692	66,789	65,272	73,878	62,520	522,475
Misc. (gal.).....	21,089,919	20,013,294	21,217,958	24,647,645	25,874,828	26,623,539	90,637,733	91,115,337	79,127,814	400,348,067
Loss (bbl.).....	844,007	864,931	794,009	887,243	886,767	934,882	1,060,020	1,241,281	1,130,900	8,644,040

Quartermaster To Buy 5000 Class A Trucks

Between Five and Seven Makers To Get New Kind of Assembly Contracts Early in February

WASHINGTON, D. C., Jan. 19—The Quartermaster Corps will be in the market for 5000 Class A War Trucks early in February and has arranged a new scheme for placing contracts. Probably between five and seven different manufacturers will be given the assembly jobs.

Under the plan of contract devised a list of at least four and not more than seven parts makers will be made for each of the following assemblies:

Engines	Wheels
Axles, front and rear	Radiator assembly
Transmissions and controls	Springs
Clutches	Gasoline tanks, fenders, hoods and other sheet metal work.
Electrical equipment	Lamps
Universal joints and propeller shafts	Tool equipment
Steering gears	Carburetor and other accessories
Frames	
Dash assembly	
Seat assembly	

Complete sets of drawings and parts lists will be sent to each of these parts makers and each will be provided with a schedule of quantities ranging from 1000 to 3500. The makers will submit bids by mail within 10 days after receipt of prints, to Col. Drake, Quartermaster Corps, Washington, D. C., and all bids are to be f.o.b. factories. Maximum prices are to be submitted by parts makers to truck assemblers when quotations are asked by assemblers.

Government May Buy Tools

Costs of tools, jigs and fixtures are also to be submitted and the Government will have the option of purchasing any sets of these tools and fixtures at the conclusion of the contract, subject to a suitable depreciation.

The Engineering department of the Military Truck Production Section of the Quartermaster Corps will furnish any necessary weights, etc., of parts specified in drawings.

Parts makers are being advised by letter that 5000 Class A trucks will be ordered for delivery in July, August and September and that these trucks will be purchased by the Government from the truck makers completely assembled and that all parts will be purchased and furnished complete by truck makers.

Inspection to Be Rigid

Van Dyke prints and lists of specifications are mailed with the letters to the parts makers, the Van Dykes being marked "for estimate only." The Quartermaster Corps reserves the right to make inspection of any units furnished in the trucks either at point of manufacture or as a completed unit.

Bids found acceptable from parts makers will, if the company is satisfactory as regards financial condition, capacity and organization, be so rated and the company will be placed on an approved list of companies to be submitted to the truck maker to aid him in preparing his total bid for completely assembled trucks. Bidders are informed that prices submitted to the Government will be maximum in comparison to prices later furnished to truck makers who secure assembly contracts. The Government does not guarantee the financial responsibility of any truck maker or truck assembler to whom goods are furnished by parts makers.

Distribute Cost of Tools

Complete sets of tools, jigs and fixtures are to be made up for this work and estimated prices to be submitted in connection with bids on material, and the Government is to have the option of the purchase of these with reasonable depreciation at the expiration of the contract. The cost of these dies is to be distributed pro rata on an estimated order for 2500 parts. If a parts maker's contract for parts falls short of 2500 the Government will pay for the pro rata difference; if the order is above 2500 the tool cost will be estimated on the quantity above that number.

Parts makers receiving Van Dykes and letter invitations to bid are requested to wire at once, if interested, to P. W. Tracy, Supervisor of Parts Plants of the Motor Transport Section, 1421 Eye Street, Washington, D. C., stating if bids are to be made.

Invite Makers to Bid

Truck makers and assemblers are to be notified by letter that contracts for 5000 Class A trucks will be let shortly and invited to submit bids according to blue prints, lists of specifications and bills of materials to be provided by the Government.

Completed trucks or separate units or parts of units are to be subject at all times to inspection and rejection by the inspection division of the Motor Transport Section.

A minimum of 750 trucks and a maximum of 2000 trucks will be alloted to any one maker. Truck makers are to purchase all units and deliver them completely assembled to be accepted after final inspection by the Quartermaster Corps. The lists of approved parts makers will be given all assemblers by the Government, but no guarantee of responsibility of these makers is made, these being subject entirely to the supervision and inspection of the truck assembler.

In cases where the truck maker is also the maker of certain units, upon application, survey of his plant will be made, and if found satisfactory he will be placed upon the list of parts makers for those units he is best suited to make.

Complete sets of tools, jigs and fixtures made for this work are to be estimated in price and submitted with assembly bids. The Government retains the option of purchasing these with reasonable allowance for depreciation at the expiration of the contract. The cost of the dies is to be distributed pro rata on an estimated order for 2000 trucks, and if the order falls short of this figure the Government will pay for the pro rata difference.

A list of units and selected parts makers is sent each assembler and it is expected that parts not mentioned in the list are to be secured by the truck assembler without suggestions from the Government as to sources of supply.

Should Telegraph Acceptance

Truck makers and truck assemblers are requested to telegraph acceptance of invitations immediately to Christian Girl, Chairman of the Motor Transport Section, 1421 Eye Street, Washington, D. C.

All bids are to be open and not sealed, to secure a selective service of trucks much like the selective service of men for the army.

As far as possible tools, jigs, etc., are to be limited to three sets on all major units and less on minor units and the Quartermaster Corps reserves the right to direct the number of sets of tools to be made at its expense.

The Government reserves the right to reject any source of supply or any bid.

It is estimated that probably only five or six truck makers will be awarded the full amount of assembly contracts to thus avoid the delay and confusion arising from wide distribution of numerous small contracts.

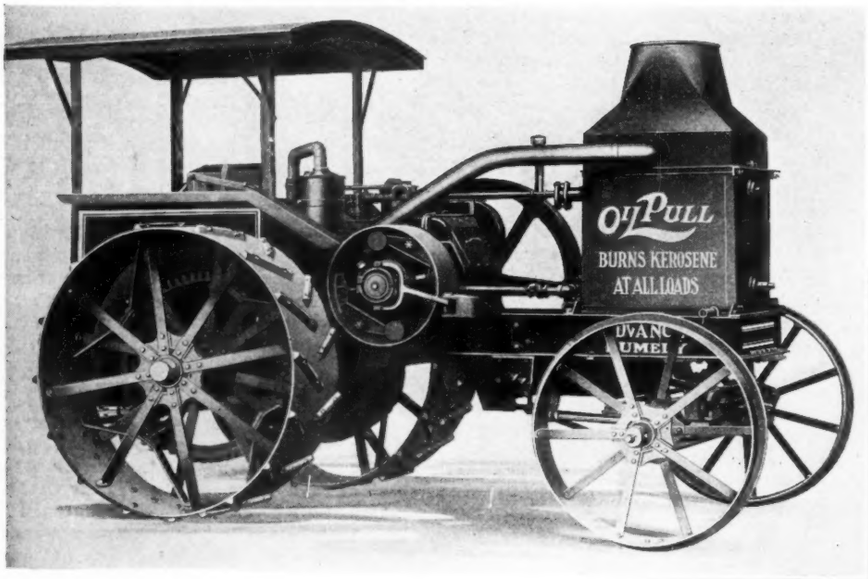
Conference of Truck Makers

A meeting of the truck assemblers and truck makers who are interested in this business will not be called until after blue prints and specifications have been sent to the parts makers and detailed specifications are completed for the entire truck. Following this it is expected that truck makers and assemblers will be asked to submit bids for final decision within 15 days after the meeting.

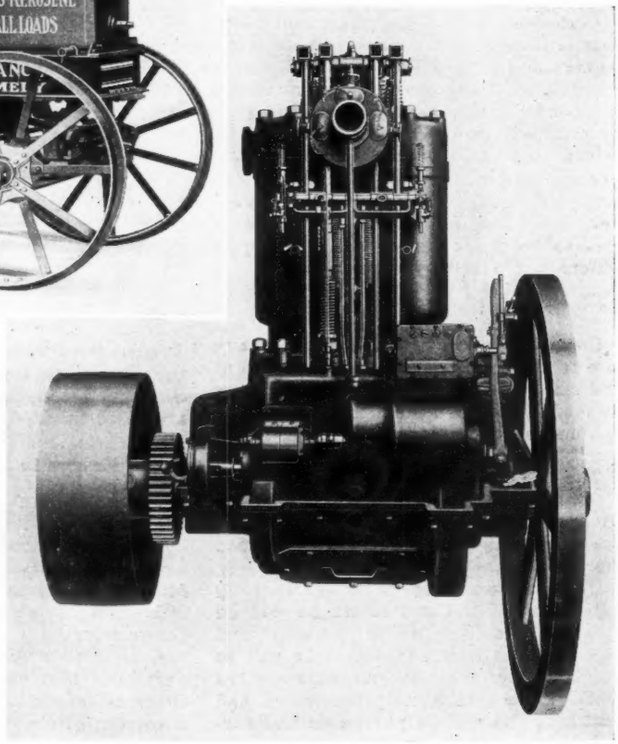
It may be possible that this meeting will be eliminated by sending the makers who display their interest the necessary information and data and then calling only for a final meeting to submit bids.

Rumely Adds Smaller Tractor Model

Has a Rating of 14-28 H. P. and Burns Low Grade Fuel—Engine of the Low Speed, Two-Cylinder, Horizontal Type, Oil-Cooled and Governor-Controlled—All Spur Drive with Cushion Springs in Differential Drive Gear



On left: A general view of the Rumely 14-28 tractor. Below: Plan view of the horizontal two-cylinder engine



RUMELY tractors employing the Secor system of burning low-grade fuel, which are manufactured by the Advance-Rumely Thresher Co. of La Porte, Ind., have long occupied a leading position in the tractor field. Heretofore they have been built in large sizes only, but, recognizing the demand for a small tractor suitable for moderate sized farms, the company has recently added to its line a new model having a rating of 28 hp. on the belt and 14 hp. at the drawbar. This model, like every other one put out by the company, is guaranteed to successfully burn not only every grade of kerosene sold in the United States and Canada, but also fuel oils and distillate free from earthy matter. While the new tractor is spoken of as a small one, it is really a rather fair sized machine, for with all supplies on board, ready for work, it weighs no less than 8700 lb., and it is guaranteed to pull up to five 14-in. moldboard plows, to turn over 14 acres of ground in a 10-hour day, and to handle on the belt a 24-in. separator fully equipped.

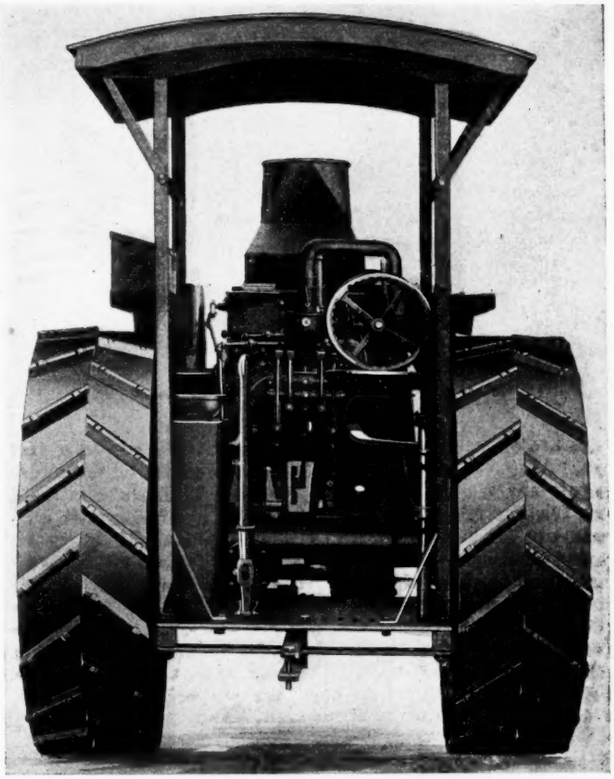
The two cylinders of the engine are cast in a single piece, but the head is separate. With a bore of 7 in. and a piston stroke of 8½ in., the engine delivers its rated power at 530 r.p.m. For the purpose of securing balanced turning the two pistons are connected to a two-throw crankshaft with the two crank pins 180 deg. apart. To further improve the balance of the engine, balance weights are secured to the two short crank arms. Each piston is provided with four diagonally split rings above the piston pin and with an oil scraping ring at the lower end. It is not necessary to disconnect any piping in order to remove the cylinder heads. The valves are operated by means of push rods extending along the top of the cylinders and by means of tappet levers provided with means of lubrication.

The camshaft is driven directly from the crankshaft by a spur pinion and gear. A small gear driven from the camshaft gear operates the flyball type of governor and the low tension Bosch magneto. On the camshaft at the opposite end from where the driving gear is located there is another gear used for operating the circulating pump. All bearings on the crankshaft are 3¼ in. in diameter. They are provided with split bushings for easy adjustment. The crank pin bearings measure 3¼ x 3¼ in. and the main bearings

3¼ x 7 in. (flywheel end) and 3¼ x 8 in. (clutch end) respectively. The crankcase is of cast iron and is split in a vertical plane through the crankshaft axis. That portion of the crankcase to which the cylinder block is bolted supports the crankshaft bearings, the latter having caps secured by four bolts each. By removing a cover plate on the outer half of the crankcase any minor adjustment can be made. Only five gears are used for driving the camshaft and the various accessories, and all of these are fully inclosed and operate in oil. The camshaft driving pinion is located on the crankshaft inside the main bearing at the flywheel end.

As with other kerosene burning tractors, it is necessary to start on gasoline. The fuel tank has a capacity of 31 gal. of kerosene and 3½ gal. of gasoline for starting. The Secor-Higgins carbureter is used, and a sectional view of same is shown herewith. It will be seen to have two horizontal nozzles with a number of outlets each. One of these nozzles is for the kerosene and the other for the gasoline. One butterfly valve is located above the nozzles and permits of increasing the suction at will. The other butterfly valve, below the nozzles, serves for throttling the engine. With the Secor system water is injected into the cylinders to prevent pre-ignition when running under heavy loads.

Ignition is by low tension or make-and-break sparks. The spark plugs are manufactured by the Rumely company itself. The magneto which furnishes the current is of Bosch make. By referring to the cut of the engine in which the outer part of the crankcase is removed it will be seen that there are six cams on the shaft. The two inner ones of these actuate the spark mechanism. The trip rods can be easily adjusted for timing.

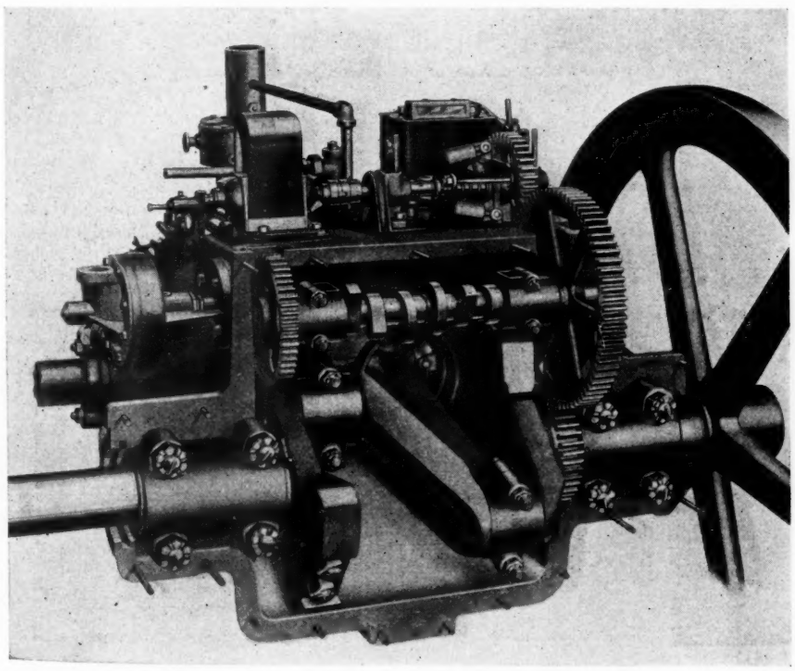


Rear view of tractor showing arrangement of controls

Engine Oil-Cooled

One of the features that undoubtedly adds to the success of the oil burning system is the use of oil cooling. Owing to the fact that mineral oil has a very much higher boiling point than water, it is possible to operate the engine cylinder at a much higher temperature with oil than with water cooling. The radiator is of the vertical type, of square cross-section, and is located at the forward end of the tractor. The capacity of the cooling system is 18 gal. No fan is required, and the power consumed in operating such a fan is therefore saved. With oil cooling the cylinder walls can be maintained at a temperature well above the boiling point of water. There are also other advantages connected with the use of oil for cooling. Oil will not freeze in the coldest winter weather, and as the oil never approaches its boiling point in the cooling system, it will not be lost by evaporation, and consequently needs not to be replenished frequently. Oil cooling is claimed to be particularly superior to water cooling when operating at low output, as in that case it is difficult to keep the cylinder wall temperature up.

Lubrication of the engine is effected partly by a mechanical oiler and partly by splash. The oiler with its sight feeds may be plainly seen on top of the engine crankcase in one of the cuts.

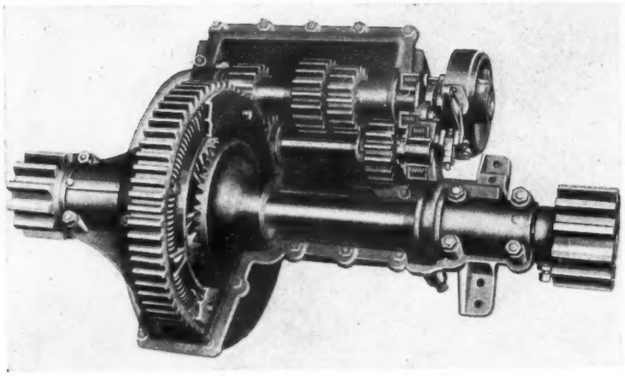


View of engine with outer half of crankcase removed

An extension of the crankshaft carries the belt pulley, which is 23 in. in diameter and has a face width of 8½ in. At 530 r.p.m. this gives a belt speed of about 3200 ft. per minute. This pulley is ordinarily loose upon the shaft, but can be secured thereto by means of the friction clutch. The clutch is of the expanding sector or shoe type, comprising two shoes operated by means of a shipping lever. The expanding members are counterbalanced so that centrifugal force has no effect on them. As the clutch is located inside the belt pulley and near the outer edge of same, it is easy to adjust it. Only one adjusting device is provided.

Transmission Two-Speed

The transmission is of the sliding pinion type and affords two forward speeds and one reverse. It is inclosed in a semi-steel casing made in two parts. Within this casing there are three parallel shafts, one receiving the power from the engine, the other one an intermediate shaft and the third the jackshaft or countershaft of the tractor, which carries at its end two bull pinions 4 in. wide each. The lower half of the transmission case is removable for purposes of inspection and adjustment. All



The two-speed and reverse transmission

gears are of steel, have machine cut teeth and run in an oil bath. A brake drum is located on an extension of the intermediate shaft outside the gear housing. This brake is lined with friction fabric and is operated by a pedal located convenient to the driver. It is said to be capable of holding the tractor securely on either an up or a down grade of any ordinary steepness, and of stopping it within its own length. All bearings on the transmission shaft are of the Hyatt flexible roller type. The two speeds are 2.1 and 3 m.p.h., and the reverse speed is 2⅝ m.p.h. In order to make possible the removal of the lower half of the gear case, the bearings are provided with caps. These caps are grooved to receive felt packing in order to make an oil-tight joint.

All Frame Members Straight

The frame is made of 8-in. heavy section channel steel, the side members and cross members being hot riveted together with angle plates. Each frame member is a straight piece, thus insuring the maximum strength. The rear axle, which is of high carbon steel 3¼ in. in diameter, is mounted in Hyatt high duty roller bearings at both ends of a tubular supporting casting of the cannon type. By the use of this type of rear axle housing a generous lubricant capacity is provided. The driving wheels are 56 in. in diameter and have a width of 18 in. They are of the built-up type with T-head steel spokes. Detachable grouters are used, which permits of the tractor being used for hauling and road work without damage to paved streets.

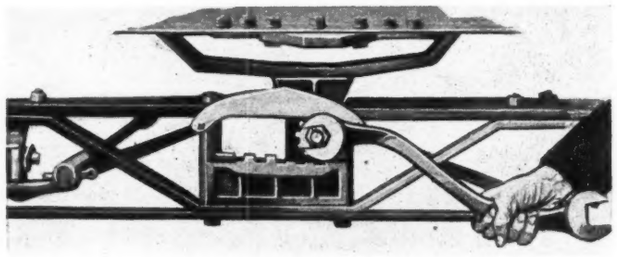
Rumely 14-28 tractor at work

The front wheels are 40 in. in diameter and have a width of 7 in. A built-up front axle is used, thoroughly braced. The steering gear is of the automobile type, the tractor being steered by means of a hand wheel, the shaft of which extends forward and carries a worm at its end. In order to permit the front wheels to accommodate themselves to sloping ground the front axle is pivoted at the center. To provide plenty of belt clearance, an arrangement is provided whereby the front axle can be moved laterally with respect to the frame whenever it is desired to use the tractor for belt work. This arrangement is clearly shown in one of the illustrations. On the pivot spindle of the frame there is a spur pinion which engages with a rack on the front axle. When it is desired to move the axle laterally, all that is necessary to do is to loosen a locking device on the axle and move the axle over by means of a wrench applied to a hexagon part on the pinion, which latter can be moved half a turn. This arrangement permits of the use of high front wheels properly placed, in connection with a belt pulley driven direct from the crankshaft.

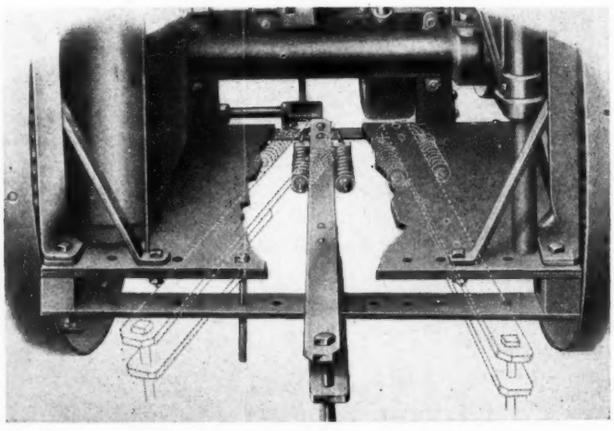
Operator's Platform Low

The operator's platform is placed quite low, only a step from the ground. A canopy over the driver's seat is regular equipment and is so constructed that the operator has a clear view in every direction. An arm rest is provided at a convenient height. All of the control devices are within easy reach, including the gear shifting lever, the clutch lever, the steering wheel, the brake pedal and the carbureter and ignition hand levers. The gearshift lever works on a slotted quadrant, the control being of the selective type. The fuel tanks, which are calculated for a day's supply, are so located as to be easily accessible for filling.

The drawbar construction is referred to as of the swinging, spring cushion type. It is located directly below the platform and so designed that the hitch can be made at from 14 in. to 19 in. above the ground, with a wide range of lateral adjustment.



Arrangement for moving front axle sideways



The spring-cushioned, laterally adjustable drawbar

An Agricultural Power Unit*

Some Factors Governing the Design of a Small Tractor—Problems New to the Mechanical Engineer Involved—A Variety of Possible Types Considered

By Alan E. L. Chorlton

THE problem of providing mechanical power, to replace that of the horse, etc., in the most suitable and efficient form for the purposes of agriculture, is one of no inconsiderable difficulty, the guiding factors being such variables as the size of the farm, the class of land, the nature of crop, road transportation and the financial ones of first cost, annual charges, etc. The information relating thereto is so diverse, so variable and difficult to relate to actual fact (it seems more often a matter of opinion rather than fact) that the mechanical engineer investigating the problems on lines he is accustomed to finds himself at some loss where to begin, and is driven in the end, owing to this lack of precise information, to provide much of the essential data by actual experiment.

In this problem the difficulty of bringing together the agricultural expert and the mechanical engineer is a very real one. This difficulty is reflected in the tardy progress in this country of mechanical agricultural science, which, apart from the conservatism of the farmers themselves, has undoubtedly depended upon the cut-and-try methods so familiar in the past, and not upon scientific and technical research.

Though in the main the views held by farmers may be divided into two groups, those who favor a special power implement for each purpose and those who think a general purpose machine should be provided to deal with each and all, yet the problem should undoubtedly be considered, in the first instance, from the standpoint of capital expenditure and annual charges. The average farm in this country is comparatively small, and the farmer may find it financially impossible to purchse a special power-driven implement for each of his requirements, even should he be of opinion that such a policy is a desirable one. For example, if a light tractor were purchased for plowing alone, then a power unit would be needed for threshing, while on the road provision must be made for the mechanical power required for transport. A fourth power unit may even be required for other purposes, thus, a first cost of say £350 per unit might be increased approximately to £1,050, or even to £1,400, while the yearly writing off of capital, interest, etc., would be increased proportionately, each requirement now having to bear the full charge of its special machine. The effect on the working costs of the writing off of so large a capital expenditure incurred by unipurpose machines is very material; for example, the capital charges for a tractor costing £350 suitable for plowing alone, and allowing seven years' life and 100 acres per year, would be 10s. per acre, for 200 acres 5s. per acre, and even if an allowance is made for performance of light land work, subsequent to plowing, the cost would probably amount to 3s., equivalent to the cost of fuel (at 3 gal. per acre), and as great as, if not greater than, the wages of two operators.

The financial consideration of the problem brings out the advantages of a multi-purpose machine, a power unit—if it could be designed—to meet the majority of calls of the farmer, instead of a special power implement for each purpose. Such a desirable combination should never be lost sight of in any general investigation of the fundamental factors of design.

There will always be farms so large or special conditions of such a nature as to allow of the purchase of special machines for each purpose with a commercial advantage; such cases, however, must be considered individually, and are not dealt with here. There is no doubt, however, that despite the questionable soundness from a commercial point of view, of the use of many special purpose units for the average farm, there still remains a strong body of opinion that the use of such power implements is the right thing, and only the showing of the future, when the farmer has purchased on these lines, will clearly demonstrate whether due consideration had been paid to the financial aspect of the problem.

It is essential to bear in mind the incidence of the various duties called for from the tractor; will they so fall as not to

*Paper presented to the Institute of Automobile Engineers—slightly condensed.

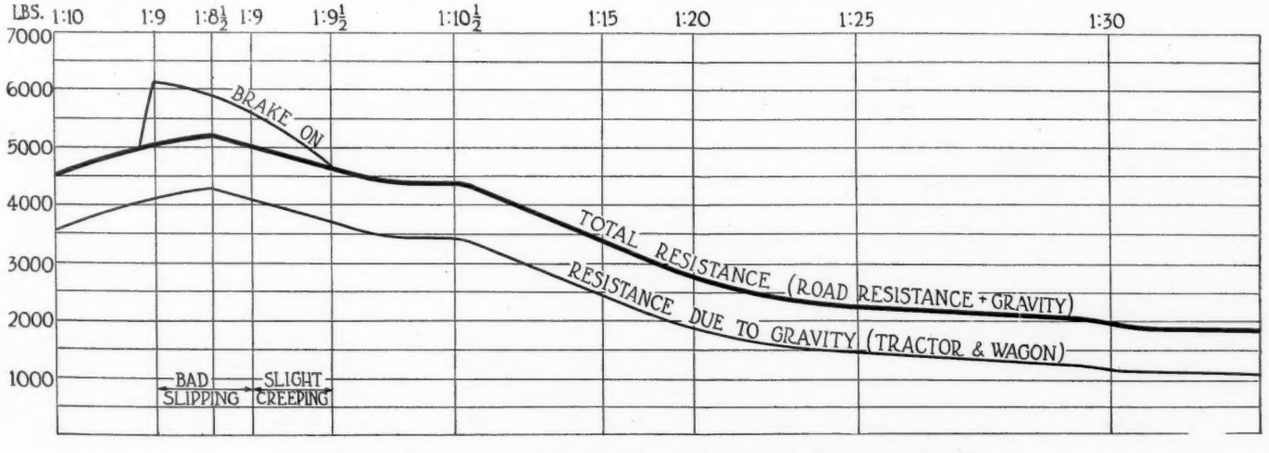


Fig. 1—Results of Road Resistance and Adhesion Tests (September 12, 1917)

Gross weight of tractor, 7.4 tons; gross weight of wagon, 8.7 tons; gross weight of complete train, 16.1 tons; weight on driving wheels (3 ft. 6 in. x 12 in.) 10,000 lb.; adhesion factor, without slip, 0.46. With slight creeping, 0.56, max., 0.62; road resistance per ton, av., 53 lb.; average speed, 1¾ m.p.h.; road surface, very good macadam, dry

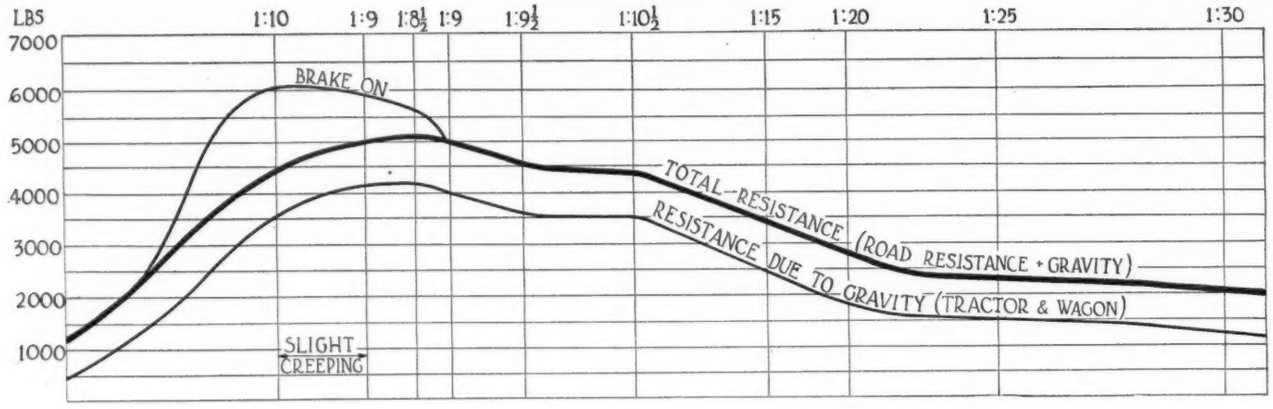


Fig. 2—Results of Road Resistance and Adhesion Tests (September 11, 1917)

Gross weight of tractor, 7.4 tons; gross weight of wagon, 8.7 tons; gross weight of complete train, 16.1 tons; weight on driving wheels (3 ft. 4 in. x 10 in.), 10,000 lb.; adhesion factor, without slip, 0.58; with slight creeping, 0.6; road resistance per ton, av., 53 lb.; average speed, 1½ m.p.h.; road surface, very good macadam, dry

conflict? That is to say, can the uses of such a power unit be reasonably well divided to cover the agricultural year with the help of horses which will be always available to a limited extent? It is held that they can, though each farmer must with his own conditions in front of him judge for himself. The requirements called for from a power unit during the agricultural year are:

(a) Plowing, dragging, rolling, drilling.
(b) Reaping, binding and leading.
(c) Threshing, pumping, pulping, chaff-cutting and grinding.
(d) Transport work to the station.

These duties are not likely to exceed 70 per cent of the total working days of the year.

It is not possible here to consider these operations in further detail, for we must confine our examination to the mechanical factors of the problem. The three principal uses which, by their requirements, govern the design of the tractor are:

(a) Road Work—Transport.
(b) Land Work—Plowing.
(c) Farmstead—Threshing, etc.

(a) governs the minimum axle loading, (b) governs the maximum axle loading, (c) governs the minimum power required.

Road Work

The basic factors governing the application of mechanical power for traction purposes are adhesion and resistance.

Tractive Adhesion.—The adhesion of the driving wheels on the road must be sufficient to utilize the power developed by the engine in overcoming the tractive resistance of the load and the tractor combined.

There exists a considerable amount of data relating to tractive resistance, but for tractive adhesion on common roads, little, if any, can be found. For traction on rails, the locomotive engineer has plenty of data obtained by the use of dynamometer cars, and from these have been developed recognized constants. The standard figure of adhesion is 0.25, *i.e.*, one quarter of the load on the driving axles can be used in drawbar-pull. It is stated that this figure rises to 0.35, but it is not advisable to use such a value in practice.

As no adhesion values were available for steel tires on common roads, experiments have been made to determine them. In these experiments a steam tractor was employed towing a loaded wagon by means of a recording dynamometer. In order to obtain maximum results the experiments were extended so as to traverse a steep hill, and even with this additional resistance it was still necessary to apply the brake to the wagon before the maximum value was exceeded, and slipping began.

It will be seen clearly that these experiments also afforded an opportunity of testing traction resistance constants, and this was done.

To make the results still more useful, the same tractor was fitted with rubber tired wheels and tested under similar conditions. The whole forms quite a useful combination of data for the designer of tractors for common roads, and the author is much indebted to Messrs. Ruston, Proctor & Co. for enabling the tests to be carried out. These results are shown in the Tables of experiments, Figs. 1 and 2.

From these it will be seen that the maximum value—*i.e.*, with slipping just beginning—is for steel tires 0.56, and for the rubber tires 0.6. It is suggested that in practice where country roads have to be taken into account, a safe value for steel tires would be 0.45, and for rubber tires 0.55, or if long life of tires is desired 0.5. This means, in effect, that in getting out the design of the tractor for road transport, which duty limits the minimum weight, the propulsive effort cannot be taken as exceeding 0.45 times the weight on the driving axle for steel tires. The high cost of rubber tires for road purposes with their special wheels seems hardly justifiable for the conditions obtaining on a farm.

Traction Resistance.—From the experiments, Figs. 1 and 2, the tractive resistance for a good macadam road comes out at just over 50 lb. per ton, the diameter of the hind wheels of the loaded wagon being 4 ft. by 9 in., that of the front 3 ft. 6 in. by 9 in., with steel tires. The values given in Table I are the results of experiments lately carried out over roads in California.

TABLE I—TYPICAL RESULTS FOR VARIOUS SURFACES

Test No.	Kind of Road	Condition of Road	Location	Traction Resistance	
				Total	Per Ton
29—30—31	Concrete (unsurfaced)...	Smooth, excellent	Near Davis	83.0	27.6
*11—12	Concrete (unsurfaced)...	Smooth, excellent	Near Davis	90.0	30.0
26—27—28	Concrete..... (⅜-in. surface asphaltic oil and screenings)	Smooth, excellent	Near Davis	147.6	49.2
13—14	Concrete..... (⅜-in. surface asphaltic oil and screenings)	Smooth, excellent	Near Davis	155.0	51.6
9—10	Macadam (water-bound)	Smooth, excellent	Near Davis	193.0	64.3
22—23	Topeka on concrete.....	Smooth, excellent	Near Davis	205.5	68.5
8	Gravel.....	Compact, good condition	Near Davis	225.0	75.0
†45—48	Oil macadam.....	Good, new.....	Near Sacramento	234.5	78.2
‡46—47	Oil macadam.....	Good, new	Near Sacramento	244.0	81.3
33	Gravel.....	Packed in good condition	Near Davis	247.0	82.3
18—19—20	Topeka on plank.....	Good condition, soft, wagon left marks	On Causeway near Davis	265.0	88.3
34	Earth road.....	Firm, 1½ in. fine loose dust	Near Davis	276.0	92.0
24—25	Topeka on plank.....	Good condition, but soft	Near Davis	278.0	92.6
1—2—3	Earth road.....	Dust ¾ to 2 in...	Near Davis	298.0	99.3
3—4	Earth.....	Mud, stiff, firm underneath	Near Davis	654.0	218.0
6—7	Gravel.....	Loose, not packed	Near Davis	789.0	263.0

*Graphic record indicates that the load was being accelerated when the test was started.
†Drawn with motor truck at 2½ miles per hour.
‡Drawn with motor truck at 5 miles per hour.

For the purposes of this investigation a value of 60 lb. per ton has been taken.

Having now the values for adhesion and resistance, it is necessary to inquire as to the load a farmer will require for road transport. As it is desirable that the tractor should work on the land with practically the same efficiency as a special purpose machine, heavy axle loading is prohibited, and it becomes necessary to proportion the tractor weight to fulfil this condition, and yet permit of the requisite adhesion for hauling the load on the road.

When the tractor is hauling a wagon in ordinary service the load may be adjusted to any condition or gradient. Is there, however, any other governing condition in which this adjustment cannot be made? A load that is in one, so to speak—and here a full-sized 4 ft. 6 in. threshing machine may be taken as a guide—such a machine weighs 4¼ tons, as a safe maximum say 4½ tons.

The next consideration is the reasonable maximum gradient a tractor may be called upon to face. If a maximum gradient of 1 in 10, and a tractor weight of 50 cwt. is assumed, we have 224 + 60 = 284 lb. as the total resistance per ton. Then the total load of 4.5 tons plus 2½ tons equals 7 tons, or a total propulsive effort of 1988 lb., which gives us, with a 0.45 traction adhesion, a load of 4400 lb. on the driving-axle. Obviously with a tractor of a total weight of but 2½ tons (say 15 cwt. on the front axle and 35 cwt. on the back), this axle weight cannot well be provided. The increased loading on the axle due to the reaction of the drive, the values of which are shown in Fig. 3, provides however a means of meeting this difficulty. The alternative method is to adopt artificial loading on the axle. Resolving the drawbar-pull into engine power at 2 m.p.h., at 70 per cent gearing efficiency we got a brake horsepower of the engine of 15.2, and at 80 per cent efficiency the power would be 13.2 approximately.

For still heavier loads or steeper gradients a larger power is required, and it is desirable therefore that this be provided if not incompatible with the other factors.

Work on the Land

The governing factors of successful working on the land are not easily determined, and apart from the difficulty of carrying out experiments there are such intangible things as the varying opinion as to allowable pressure on the soil to be taken into account.

It may be said generally, however, that weight is a very important consideration, and must not exceed a certain maximum, while additional tractive effort in excess of that consistent with this weight must be obtained by other means, projections on the wheels, spuds, etc.

The pressure which worked land will bear without injurious effect upon the crops, varies of course according to the nature of the soil. From the mechanical point of view the limit of pressure is set by the necessity to prevent sinking into the ground, an occurrence which is seldom solely due to excessive weight.

What usually happens is that owing to inadequate gripping power the driving wheels rotate and act as milling cutters, scraping out the soil from beneath.

The relative values of weight and spud area are very difficult to allocate so as to be able to make comparisons: for instance, a machine with a 30 cwt. axle loading and short spuds pulls partly by adhesion and partly by grip, and the latter is rendered more effective by the weight of the wheel holding the ground down during this action. On the other hand, a lighter tractor with 15 cwt. axle loading must pull very largely by grip alone, and the effectiveness of the grip is modified and reduced by the lighter weight behind it, and the greater rolling resistance per ton set up by the spuds.

Hence it will be seen that the data to be ascertained are the proper relation of pressure on the land, the pressure against it, and the action of the rim projection, strake, spud or grouser.

We have thus three prime conditions to be met for the majority of cases—

(a) Driving axle loading,
(b) Pressure against grips or spuds,
(c) Effect of rolling resistance.

Considering first pressures that have been usual on land work, we have:

Man's Shoes	8½	lb. per sq. inch
Horse's Hoofs	20	" " "
Cart Tires—		
Load 2 tons	40	" " "
Oil Tractor in use—		
3 tons on axle	25	" " "
with extension	16	" " "
Steam Tractor—		
3½ tons on axle	17	" " "

Assuming from our previous figure a static axle loading of 3920 lb., then with the driving wheels of the tractor 48 in. diameter by 12 in. wide, we get with a contact area of 288 sq. in. (sinkage of wheel ¾) a pressure per square inch of 13.6 lb.

The second part of the problem is more difficult, owing to the absence of data, but concluding that the strength of the ground is represented by its resistance to ploughing, Fig. 4 is useful.

Considering first pulling by grip alone (light tractors in Fig. 5) the suggested allowable pressures against a spud are given, and for average land 50 to 75 lb. per square inch may be taken as corresponding to approximately a plough resistance of 9 lb. per square inch. If it is assumed that the drawbar-pull is 2000 lb., and the loading 50 lb. per square inch, the pull if taken by one spud in each wheel would be 1000 lb., so that for a 12 in. wide wheel the spud would be 1.67 in. long for average land.

For light lands when the strength of the soil is low, with the same drawbar-pull, this depth would have to be increased about four times, *i.e.*, the spud would be 6.7 in. based upon the relative resistance given in the above table. This cannot be considered as a proposition to be recommended, owing to the necessarily greatly increased rolling resistance of the tractor, and a special device becomes necessary, such as an

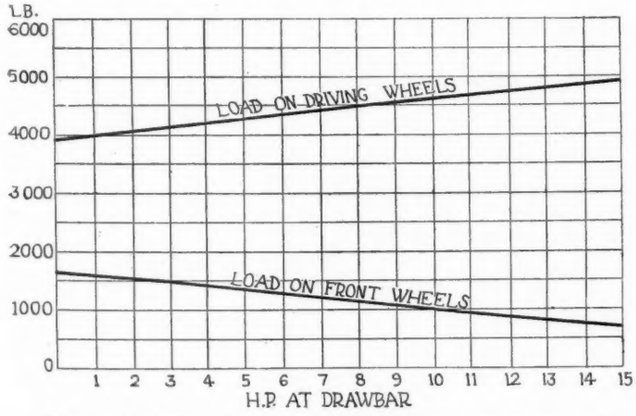


Fig. 3—Displacement of wheel loads due to turning moment and drawbar pull

Weight of tractor in working order, 2½ tons; wheelbase, 6 ft.; diameter of driving wheels, 4 ft.; height of drawbar from ground, 1 ft. 8 in.; power lost in rolling resistance taken as 20 per cent

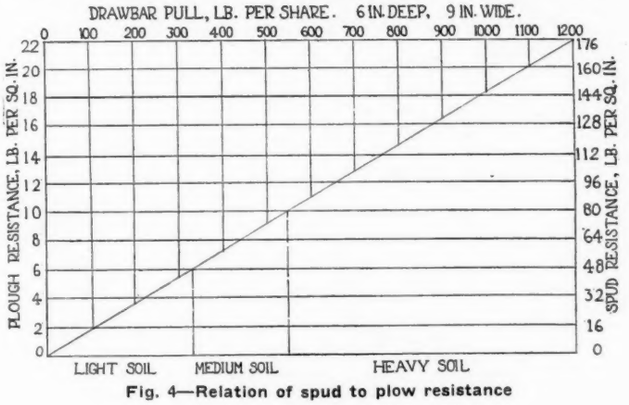
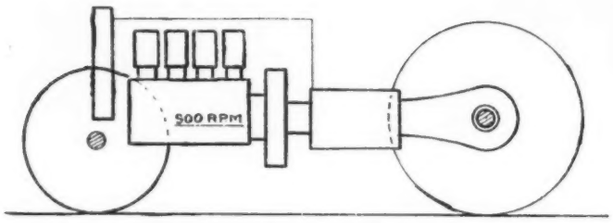
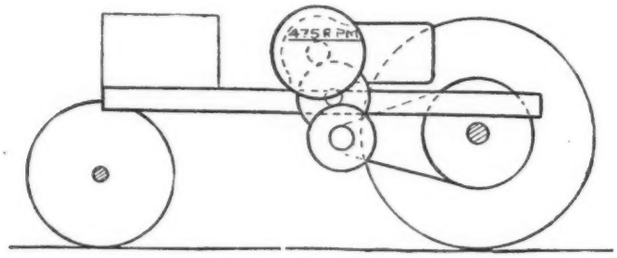

DRAWBAR PULL, LB. PER SHARE. 6 IN. DEEP, 9 IN. WIDE.
0 100 200 300 400 500 600 700 800 900 1000 1100 1200
PLOUGH RESISTANCE, LB. PER SQ. IN.
0 2 4 6 8 10 12 14 16 18 20 22
SPUD RESISTANCE, LB. PER SQ. IN.
0 16 32 48 64 80 96 112 128 144 160 176
LIGHT SOIL
MEDIUM SOIL
HEAVY SOIL

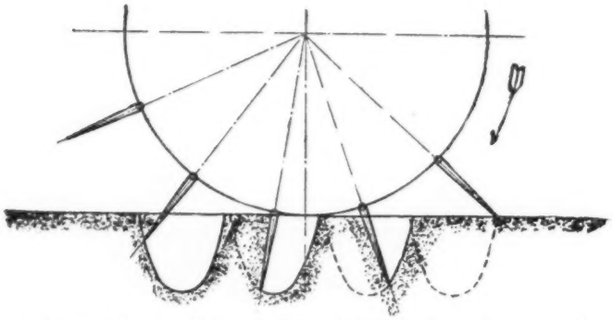
Fig. 4—Relation of spud to plow resistance



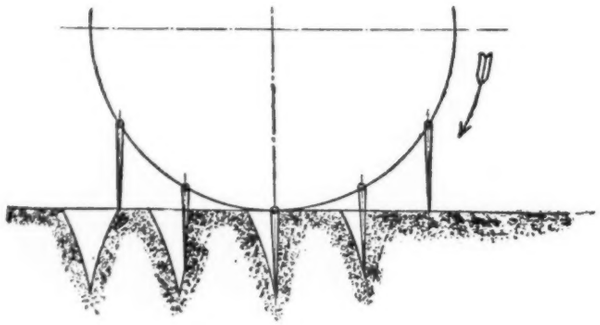
Reduction required for 2 m.p.h., 64:1 appr.



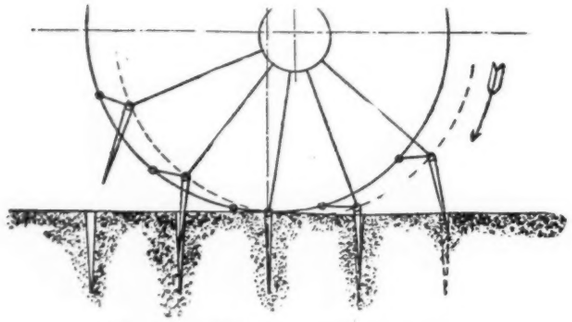
Reduction required for 2 m.p.h., 34:1 appr.
Fig. 5



Effect of fixed radial projections, indicating loss of power and increase of traction resistance



Actuated projections, parallel motion



Actuated projections, eccentric operation
Fig. 6

actuated spade, Fig. 6, fitted to the driving wheels, if efficiency is to be obtained. The mechanical complication and disadvantages of this method, even though they may be surmountable, are self-evident.

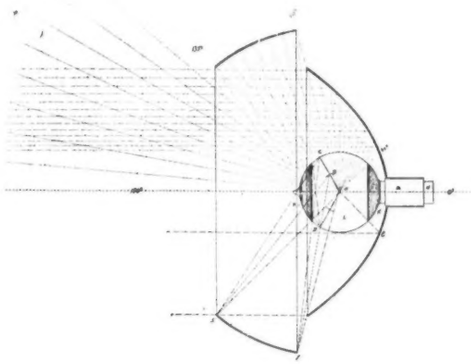
There is no doubt that many useful experiments can be carried out to determine the most efficient form of grip for varying conditions of soil and weight of tractor. On very soft land the wheeled tractor, either by reason of weight or spud pressure, is not suitable, and one of the track-laying type becomes essential. This, however, cannot be said to be at all necessary for the majority of English agricultural conditions.

(To be continued)

Some New Ideas Concerning Glare

THE subject of glare is still a mysterious one to many persons. The same as dirt has been defined as matter in the wrong place, so glare may be defined as light misdirected. When driving in an automobile at night we want plenty of light, but this light should fall on the road and not strike the eyes of pedestrians on the sidewalk or drivers of oncoming vehicles. Before the so-called glare can be eliminated it is necessary to locate the exact source of the rays that strike the driver and pedestrians.

Objectionable glare originates not only in powerful headlights, but also in the now so popular spotlights. Mr. Roffy of the Cellbeam Mfg. Co., Brooklyn, N. Y., who is probably one of the best authorities on this subject, having originated a number of headlamps and spotlamps now on the market, has a new theory regarding the cause of glare. He claims that it is entirely possible to produce a powerful projector



of compact dimension, and that the general glare emitted from bulb filaments can be reduced to a minimum by converting it into diffusive illumination.

This idea has been embodied in the Cellbeam projector recently placed on the market by the above mentioned firm. A spherical reflector corrected for aberation embraces the light source to a plane angle of 105 deg., and beyond the aperture of this main reflector there is an annulus of another reversed reflector whose focus is offset with respect to the focus of the main reflector. The result is that the light falling on this annulus is reflected onto the translucent frontal screen. The latter, receiving light from both front and rear, becomes a highly luminous surface, a surface of diffused illumination.

Italian Motor Car Industry

ITALY, in striking contrast to other European nations, has enormously increased her exports of motor lorries and cars during the last 3 years. This is shown by statistics issued by the Italian Ministry of Finance for the first five months of of 1917 (ended May 31), compared with the corresponding months of 1915 and 1916. During the first five months of 1915 Italy exported 2541 motor vehicles of all kinds. For the corresponding period of the present year the figures have been increased to 3647 automobiles.

The FORUM

Use of Heavy Fuels

By Charles E. Duryea

YOUR most pertinent remarks on heavy fuels in the issue of Dec. 6 call attention to some defects of our present construction. Using thermostats and getting as nearly to hot engines and heated mixtures as we may is, of course, along the right line, but why do we not cut the Gordian knot by going to air cooling, which uses much hotter cylinders and gets much greater economy with less complexity? The hotter cylinders not only use more of the heat produced but they have far less need for mixture heaters, for any heavy fuel deposited on an air-cooled cylinder wall finds that wall hot enough to vaporize the fuel and allow it to be burned as it should be.

I would disagree with your opinion that the change from gasoline to crude or heavier fuels will be a gradual development. On the contrary, it will be a sudden jump, brought about by the abandonment of one method and the adoption of something so totally different that there is no common middle ground. We have to-day a number of stationary and boat engines operating on kerosene which use very high pressures and show great economy. They ignite by pressure and so never miss an ignition. Surely, they have a big future. Is any one adapting them to auto work? If not, can any of your readers tell us why not?

Why do we not use coal gas made from coal as needed? Coal yields about two-thirds as much power per pound as a liquid fuel, but in a small producer we should allow some waste, say 25 per cent, which would make a pound of coal half as efficient, but since it only costs one-tenth as much it should yield five times as much power for a given cost. Is any one developing along this line? I am looking for the capital that is willing to help.

That "the thermal efficiency is such a miserable figure" is also too true. Higher compressions as mentioned above, constant compressions as in two-cycle, air cooling, leaner mixtures and similar remedies are all waiting to be further applied to the auto. When will we get them?

Hot Spot Must Be Studied

By R. J. Broege

Chief Engineer Buda Motor Co.

THE importance of the hot spot manifold cannot be emphasized too much and worked out to as near perfection as possible any too soon as to the location and amount of heat required. In fact, it is the writer's opinion that this will be very apparent this winter in the older type of engines, which have no arrangement for applying the heat to the carbureter or gas intake manifold to help vaporize the present-day fuel, which is getting heavier right along.

It is the writer's opinion that the temperatures of the gas mixtures at the moment of entering the cylinder are considerably lower than the general opinion among engineers and are governed by the amount of vacuum caused by the intaking of the gases.

The writer has not yet checked the exact temperature at the moment of the inlet, but past experience with the combination of the exhaust and intake manifold has led the writer to the belief stated above. We have made up a combination exhaust and intake manifold, the intake being entirely exhaust jacketed with the exhaust gases flowing directly around it and out through the manifold to the muffler. In the first place, this combination of gas intake and exhaust manifold led the writer to believe that this intake manifold would receive too much heat from the exhaust gases, but upon tests we find that there does not seem to be any appreciable difference between using 68 gasoline or straight kerosene. In fact, the horsepower showed in favor of the kerosene with either using additional hot air or without any additional hot air. The horsepower curves seemed to drop off 6 lb. on a 21-in. arm when using the hot air, whereas the maximum power obtained by the same engine is less than 10 per cent off the power obtained from a similar sized engine with a cold intake manifold or when entirely water jacketed.

The writer has had no chance to have a cold manifold made up so as to get the extreme conditions between the cold manifold and an exceptionally hot manifold with the entirely cold manifold or one entirely exhaust jacketed. As soon as we have these manifolds we contemplate conducting further experiments.

The Roadtractor

By George T. Strite

FOR years the farmer has been using his farm tractor when he has one for hauling large quantities of grain and other farm produce to the railroad station. For years he has been trying to use the same farm tractor to build new roads and keep up the roads. The farm tractor was designed and built for farm work on generally soft fields and farm lands. Some of the larger tractors have been fairly successful for building new roads and heavy grading.

There should be a machine designed and built especially for this work. I see no reason why such a machine should not be successful for both road building or at least keeping up good roads and also be with possibly some slight changes satisfactory for farm transportation work.

The farm tractor is designed to trail or carry all its load behind itself at a speed of 2 to 2 1/3 m.p.h. The present tractor is generally equipped with two speeds and sometimes three in which there is a low speed about 1½ to 2 m.p.h. and a high speed of 3 to 4 m.p.h. The two-speed tractor always has the plowing speed, generally plowing and high speed; and sometimes plowing speed and low speed. The plowing speed is used 85 per cent of the time. The low is used on hills and hard strips of plowing, generally gumbo streaks, which pull very hard.

The farm wagon seems to be the most practical vehicle for carrying most of the farm produce. The farm wagon will trail and carry heavy loads behind a tractor on plowing speed loaded, and on high when empty. On fairly good roads the farm wagon loaded will stand a speed of about 2¾ to 3¼ m.p.h. On rough roads 2 to 2 1/3 m.p.h. Empty they will stand a speed of 4 to 5 m.p.h. on good roads and 3 m.p.h. on bad roads. The road drag can run at 2¾ to 3¼ m.p.h., but this is generally too fast in my experience for the light road grader, which should travel at a speed of about 2 to 2 1/3 m.p.h.

It would seem the proper speeds for the roadtractor would be low about 2¼ m.p.h. If there is any direct speed it should be intermediate speed, as 60 to 70 per cent of the work will be done on this speed.

The farm tractor or truck will not be a satisfactory roadtractor for the following reasons:

First: The farm tractor is too slow and even if geared up is not built to stand road work or hard road travel.

Second: It is not sufficiently spring mounted or flexible enough for road work.

Third: The wheels on the farm tractor will not stand the constant vibration of road travel on road work. For farm work and pulling a heavy load on soft ground the wheels must be much larger and wider than necessary for road work or travel.

Fourth: The driver on the farm tractor is in the wrong place for road work.

Fifth: For either farm transportation or road making the truck is too fast and not capable of sufficient trailing capacity.

Sixth: For either farm transportation or road making the farm tractor lacks durability for the work, as it was not designed or built for this work and it is not speeded right for this work.

The successful roadtractor can never be a practical farm tractor and the successful farm tractor will never be a practical roadtractor.

The roadtractor must be capable of trailing.

It must be capable of trailing from two to five loaded wagons with 50 to 80 bu. of grain each or 1½ to 2½ tons per wagon. Also it should be capable of a small load on the roadtractor at a much slower travel than the ordinary truck and faster than the regular farm tractor.

Roadtractor Three Speeds

It must have three speeds. It must be designed to run on intermediate gear 85 per cent of the time when pulling or trailing loaded wagons. The low gear must be used for rough and bad portions of the road and climbing hills, the high speed only for returning to the farm empty. I have known of many of the farm tractors, especially the single-speed tractors, to be simply wrecked by the driver being in a hurry to get home and run the motor at a terrific speed going home empty and cause more damage to his motor and tractor than the field work.

Pneumatic Tires Necessary

The roadtractor must have rubber or pneumatic tired wheels and at the same time be so made that lugs or grounders can be put on. It would seem to me that a spring suspension could be used between the hub and the rim of the wheels. The automobile or truck would be simply impossible without the rubber or pneumatic suspension between the ground and the hub of wheel.

On the roadtractor the gears must be entirely inclosed, *final drive included.* The breaks must be many times as effective as the breaks used on the farm tractor.

The wheels could be smaller than used on the farm tractor and not so wide and larger than used on trucks. The wide wheel is a bad feature on hard roads. The wider the wheel on a farm tractor, the quicker it will go to pieces, especially on graded roads. It must also be kept in mind that if the wheels are too small and too narrow and there are only two drive wheels, then there will be trouble on soft and sandy roads where grounders must be used to increase drawbar pull to trail heavy loads.

On the roadtractor the driver's seat should be in front, as the entire attention of the driver should be on the road ahead, which is not the case with the farm tractor, as the farm tractor operator must see and control the plows and other implements behind him.

The roadtractor should be so arranged so a service or belt pulley could be quickly put on. There are times when the farm tractor is busy in the field and belt work should be done at the same time, thus promoting efficiency.

The roadtractor should be equipped with electric starter and must be equipped with electric lights or some kind of lights.

The crawler or creeper type has great advantages over the wheel type on sandy or soft muddy roads, but again it has many disadvantages on good or even ordinary roads. In the first place, I doubt if a road speed of more than 3 or 3½ m.p.h. would be practical for this type of machine. The upkeep of the tracks and parts of tracks would be great as compared with the wheel type. A satisfactory spring suspension suitable for road work would be almost out of question.

The four-wheel-drive roadtractor would be very desirable if the cost and the price it would have to sell for would not be prohibitive. The wheels could then be much smaller and narrower and still have the traction to pull the desired load.

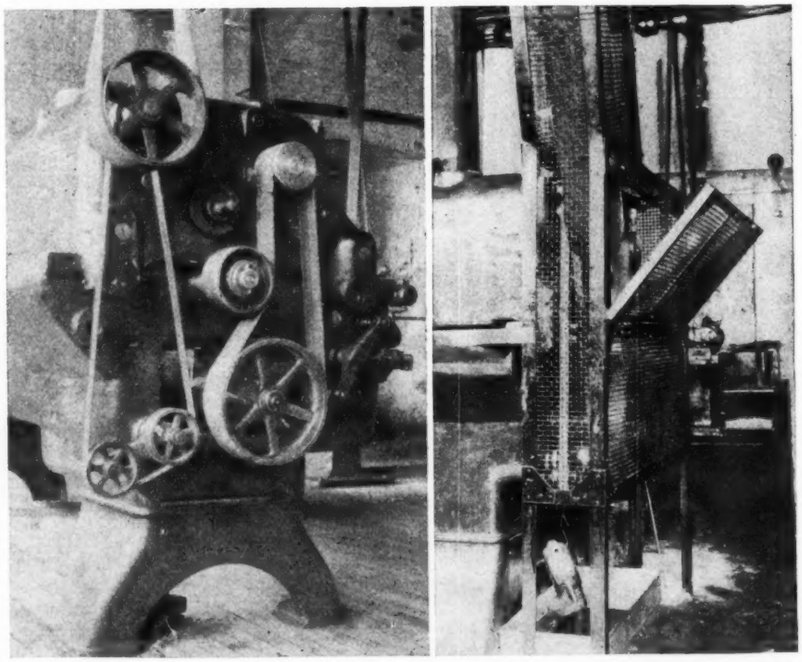
It has often occurred to me that the two rear wheels with axle and differential complete could be slipped out from under the ordinary 2½ to 3-ton truck and a set of tractor wheels with the axle and differential and proper reduction gears slipped in and coupled up to the regular standard drive shaft from transmission of the truck. This would make a three-speed outfit and this could be made to be a very satisfactory trailing outfit for road work and could also be used for pulling two plows or less in farm work in emergency.—GEORGE T. STRITE, *Tractor Engineer*, New York City.

Points in Design from a Driver-Engineer

By G. W. Bolus

THE motor base should be so designed as to permit the average driver renewing the oil in the crank base, or sump without making it necessary to drop the pan, crawl under the car and remove the drain plugs. A reasonably fool-proof valve could be arranged whereby the oil could be quickly drained from the crankcase by simply removing the motor hood. As we all know, crankcase dilution is becoming more and more of a factor in the operation of a motor car in cold weather, which makes it necessary to remove the oil more frequently, and unless the operation is made very simple, this point is very apt to be neglected or put off, to the detriment of the bearings of the motor.

I have noticed, from time to time, in the journals, comments on the slanting windshield and the hand accelerator. I submit that the slanting windshield is an advantage, not only in reducing wind resistance, but in that it entirely eliminates blinding of the driver from the headlights of a car in the rear being reflected against the windshield and into his eyes. On the hand versus foot throttle or accelerator, I think they are both necessary. We have decided use for the hand throttle when starting a car on a severe grade, as it is necessary to use one foot for the clutch and the other foot for the service brake, so here the hand throttle comes in very handy in bringing up the speed of the motor to a point where it will pick up the load.



Safety Engineering in Automotive Plants: An automatic lathe unguarded and properly guarded

The 160-Hp. Benz Aircraft Engine

Design and Performance Data of One of Germany's Leading Aircraft Engines—Has Longer Stroke and Is Somewhat Lighter Than the Mercedes

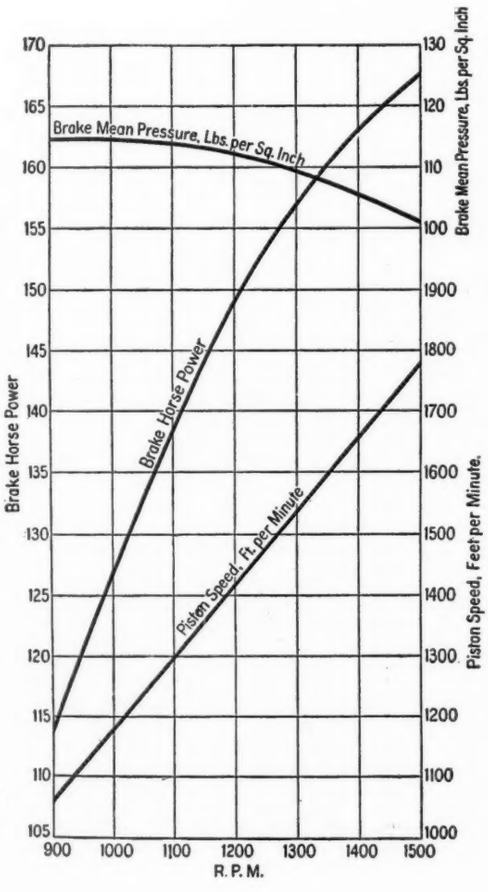
IN previous issues we have given detailed descriptions of the Mercedes 160 and 260 aircraft engines, and we are now in position to furnish rather complete data of the Benz 160-hp. engine. The data and drawings are reproduced from *The Automobile Engineer*, which published them with the permission of the British naval and military authorities.

Table I

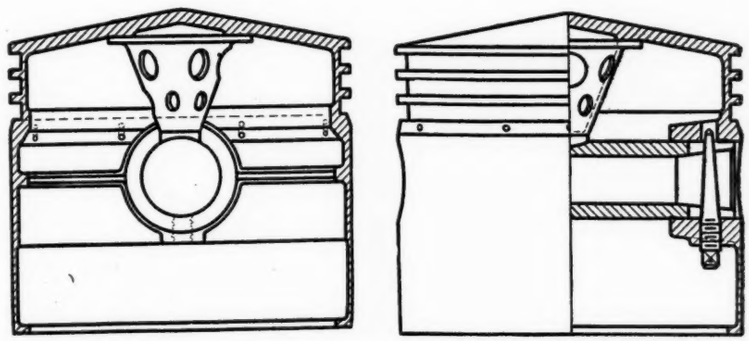
Number and arrangement of cylinders	Six, vertical
Bore, in.	5.12
Bore, min.	130.0
Stroke, in.	7.09
Stroke, min.	180.0
Stroke/bore ratio,	1.385 :1
Area of one piston, sq. in.	20.60
Total piston area of engine, sq. in.	123.60
Swept volume of one cylinder, cu. in.	146.05
Total swept volume of engine, cu. in.	876.30
Volume of clearance space, cu. in.	41.65
Compression ratio. Total volume/clearance volume	4.50 :1
Normal b.h.p., b.h.p.	160
Normal speed, r.p.m.	1,400
Piston speed, ft. per min.	1,655
Brake mean pressure, lb. per sq. in.	103.00
Mechanical efficiency (calculated), per cent	87.50
Indicated mean pressure (calculated), lb. per sq. in.	117.7
Fuel consumption per b.h.p. hour (s.g. 0.730), lb.	0.520
Brake thermal efficiency (18,600 B.t.u.'s/lb.), per cent	26.32
Indicated thermal efficiency, per cent	30.10
Air standard efficiency, per cent	45.20
Relative efficiency, per cent	66.60
Cu. in. of swept volume per b.h.p., cu. in.	5.48
Sq. in. of piston area per b.h.p., sq. in.	0.773
Hp. per cu. ft. of stroke volume, hp	315.5
Hp. per sq. ft. of piston area, hp	186.4
Direction of rotation of crank and propeller	Anticlock
Normal speed of propeller, r.p.m.	1,400
Oil consumption per hour (specific gravity, 0.900), lb.	4.93
Oil consumption per b.h.p. hour, lb.	0.031
Number of carbureters	Two
Type of carbureters	Benz
Fuel consumption per hour (specific gravity, 0.730), lb.	83.2
Number and type of magnetos	Two ZH6 Bosch
Firing sequence of engine	1, 5, 3, 6, 2, 4
Ignition timing (degrees early, full advance)	32
Inlet valve opens	Top dead center
Inlet valve closes	60 deg. late
Exhaust valve opens	60 deg. early
Exhaust valve closes	18 deg. late

Table II—Calculated Friction Losses (Lb. per sq. in. of piston area)

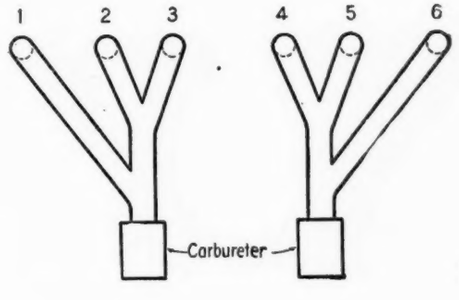
Bearings, valve gear and auxiliaries, lb. per sq. in.	2.00
Fluid pumping loss, lb. per sq. in.	4.50
Piston friction, lb. per sq. in.	8.20
Total losses, lb. per sq. in.	14.70
Brake mean pressure, lb. per sq. in.	103.00
Calculated indicated mean pressure, lb. per sq. in.	117.70
Calculated mechanical efficiency, per cent	87.50

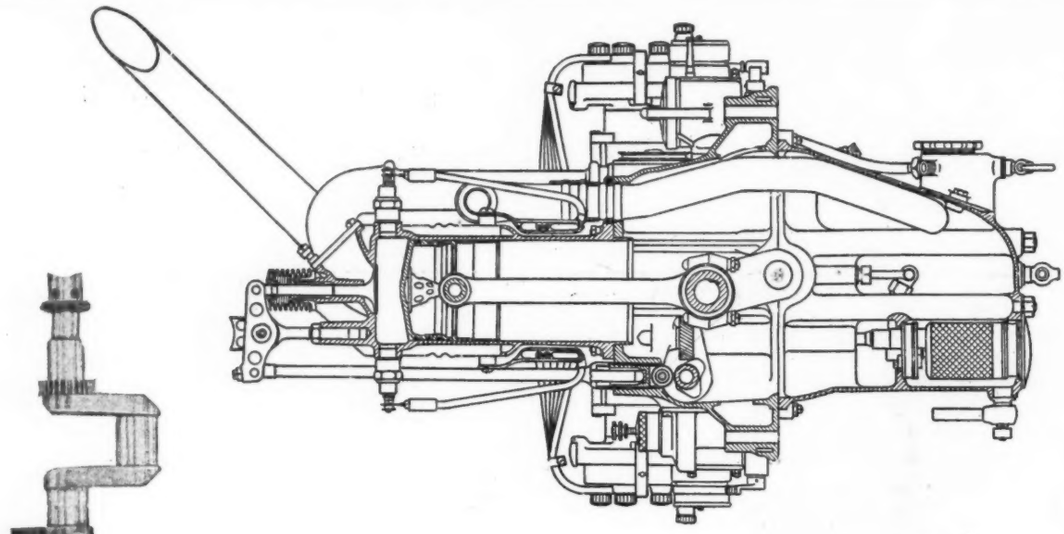


Left — Horsepower and b.m.e.p. curves. Right—Arrangement of inlet manifolds

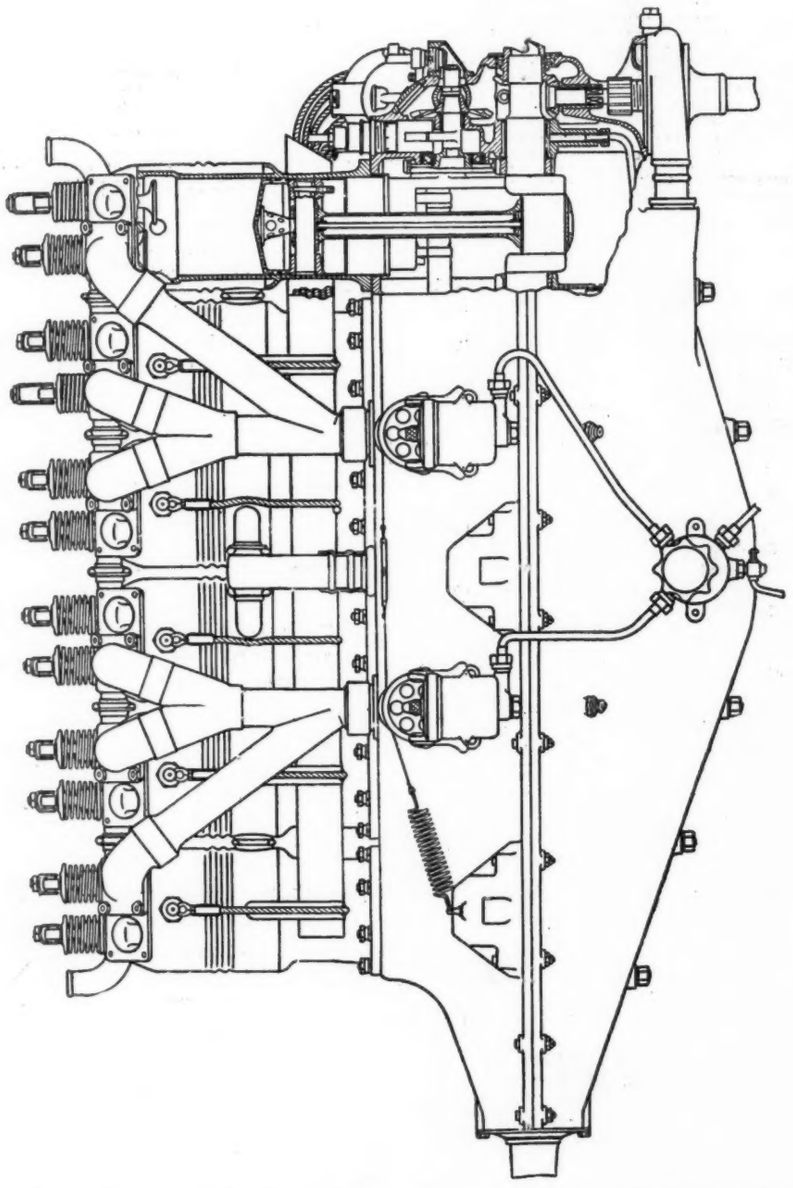


Piston construction, showing pressed-steel brace between head and pin

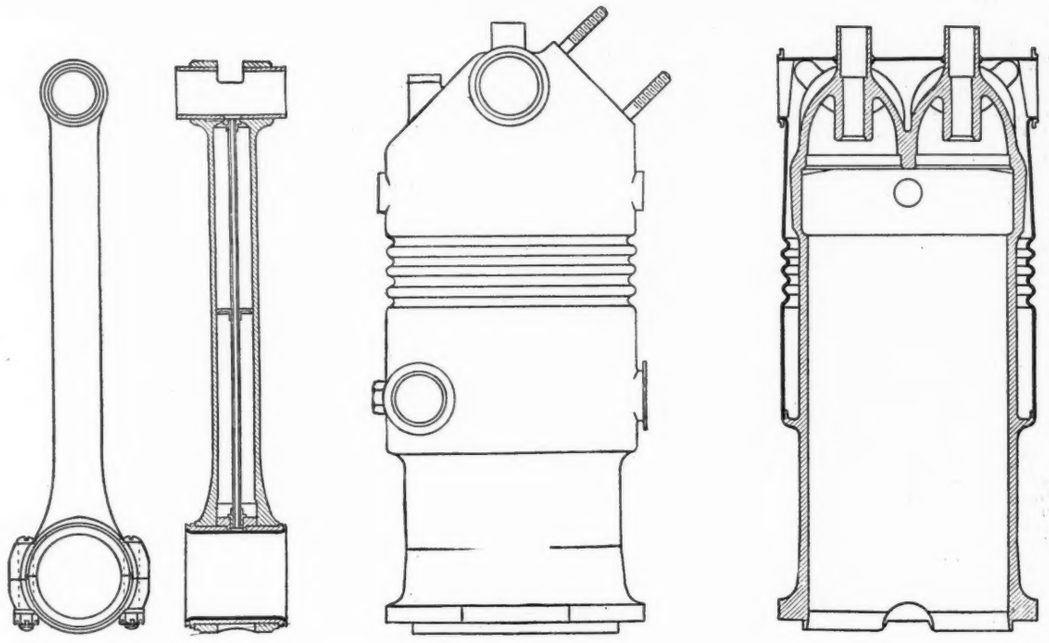


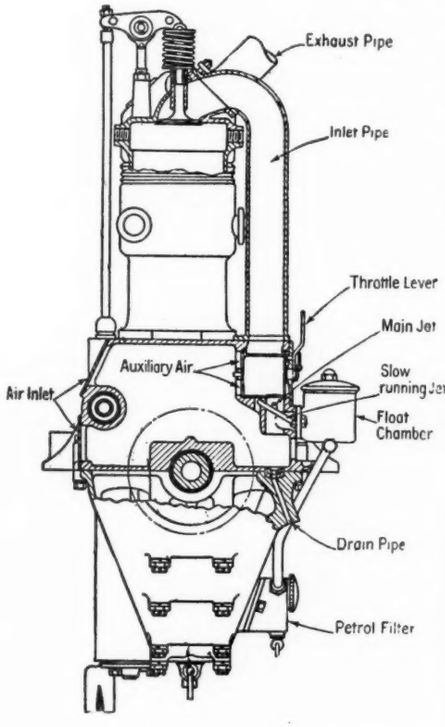


Benz crankshaft with propeller hub

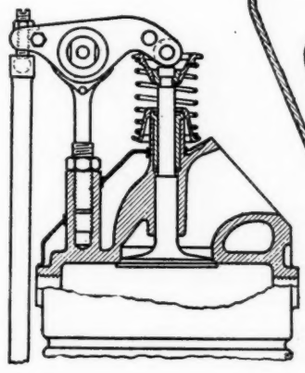


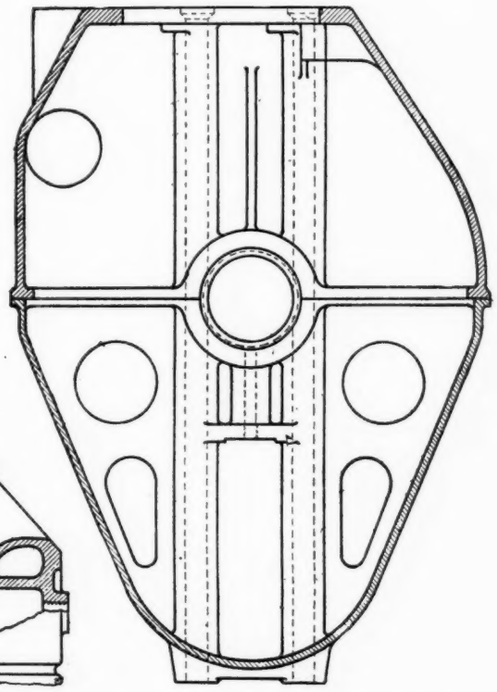
Longitudinal elevation, partly in section, and cross-section of the Benz engine





Above—Tubular connecting-rod with central oil lead for piston pin; also cylinder unit. On left, induction system; on right, section through crankcase; below, valve mechanism





A characteristic feature of the Benz engine is the long through bolts by means of which the two halves of the crank chamber are held together. The length of these through bolts varies, those at the middle of the engine being longest and those at the ends shortest, owing to the slope of the crankcase bottom. The crankshaft is supported between the two halves. Apparently these through bolts also serve as cylinder holding down bolts, though this cannot be seen from the drawings. There are, of course, a good many additional holding down bolts

Table III—Gas Velocities, Valve Areas

Gas velocity (feet per second)—	
Vertical induction pipe	192.0
Induction manifold (or branch pipes)	192.0
Inlet port	123.6
Inlet valve	172.8
Exhaust valve	172.8
Exhaust port	123.6
Exhaust branch pipe	192.0
Cross sectional area (sq. in.)—	
Vertical induction pipe	2.980
Induction manifold (or branch pipes)	2.980
Inlet port	4.600
Inlet valve ($\pi dh.$)	3.290
Exhaust valve ($\pi dh.$)	3.290
Exhaust port	4.600
Exhaust branch pipe	2.980
Diameter (in.)—	
Vertical induction pipe	1.950
Induction manifold (or branch pipes)	1.950
Inlet port	2.420
Exhaust port	2.420
Exhaust branch pipes	1.950

Table IV—Inertia Forces, Bearing Loads, Etc.

Weight of piston, complete with rings and gudgeon pin, lb.	5.00
Weight per sq. in. piston area, lb.	0.2428
Weight of connecting rod complete, lb.	5.00
Total reciprocating weight per cylinder, lb.	6.80
Weight per sq. in. piston area, lb.	0.330
Length of connecting rod, in.	12.37
Ratio. Connecting rod/crank throw	3.50:1
Inertia. Lb. sq. in. piston area. Top center, lb. sq. in.	83.60
Inertia. Lb. sq. in. piston area. Bottom center, lb. sq. in.	46.40
Inertia. Lb. sq. in. piston area. Mean, lb. sq. in.	65.00
Weight of rotating mass of connecting rod, lb.	3.20
Total centrifugal pressure, lb.	633
Centrifugal pressure, lb. sq. in. piston area, lb. sq. in.	30.70
Total loading due to inertia and centrifugal pressures, lb. sq. in.	95.70
Mean average fluid pressure, including compression, lb. sq. in.	42.50
Mean average loading on crank pin bearing, total from all sources in terms of lb. sq. in. piston area, lb. sq. in.	116.50
Diameter of crank pin, in.	2.165
Rubbing velocity, ft. per sec.	13.22
Effective projected area of big-end bearing, sq. in.	4.860
Ratio. Piston area/projected area of big-end bearing	4.18:1
Mean average loading on big-end bearing, lb. sq. in.	487.00

Table V—Cylinder Dimensions

Overall height of bare cylinder from top of base chamber	16.260"
Depth of spigot at base of cylinder	0.2756"
Diameter of cylinder over water jacket	6.417"
Valve centres	2.756"
Thickness of flange at base of cylinder	0.512"
Number of holding-down studs per cylinder	Eight.
Diameter of holding-down studs	0.394"
Steel water jacket	No. 19 S.W.G. (0.040")
Mean thickness of combustion chamber wall	0.2756"
Bursting stress*	3715 lb. sq. in.
Mean thickness of cylinder barrel	0.1968"
Tensile stress*	2604 lb. sq. in.

*Assumed maximum pressure following several consecutive misfires; 400 lb. per sq. in.

Table VI—Valve Detail

Outside diameter	2.677 in.
Port diameter	2.420 in.
Width of seating	0.0787 in.
Radius under valve head	0.3937 in.
Lift of valve	0.433 in.
Diameter of valve stem	0.5512 in.
Length of valve guide	2.953 in.
Overall length of valve	4.921 in.
Number of springs per valve	One
Free length of spring	2.913 in.
Length of spring in position, no lift	1.968 in.
Mean diameter of coils	1.535 in. (parallel)
Gauge of wire	7-8
Diameter of wire	0.168 in.
Ratio. Length of spring/lift of valve	4.55:1
Weight of valve, complete with spring, cap, etc.	0.9926 lb.
Weight of spring, bare	0.2405 lb.

The inlet and exhaust valves are interchangeable.

Table VII—Connecting Rod and Piston

Length between centres	12.37 in.
Ratio. Connecting rod/crank throw	3.50:1
Little-end bearing. Type	Phosphor bronze bush fixed in rod
Little-end bearing. Diameter	1.180 in.
Little-end bearing. Length	2.910 in.
Little-end bearing. Projected area	3.435 sq. in.
Ratio. Piston area/projected area of little-end bearing	6.00:1
Big-end bearing. Type	White metal direct in rod
Big-end bearing. Diameter	2.165 in.
Big-end bearing. Length (actual)	2.640 in.
Big-end bearing. Length (effective)	2.244 in.
Big-end bearing. Projected area (effective)	4.860 sq. in.
Ratio. Piston area/projected area of big-end bearing	4.18:1
Number of big-end bolts	Four
Full diameter of bolts	0.3937 in.
Total cross sectional area bottom of threads	0.372 sq. in.
Maximum load due to inertia at 1400 r.p.m.	1720 lb.
Maximum load due to inertia at 1600 r.p.m.	2242 lb.
Load due to centrifugal force at 1400 r.p.m.	434.5 lb.
Load due to centrifugal force at 1600 r.p.m.	567.5 lb.
Total load on bolts at 1400 r.p.m.	2154.5 lb.
Total load on bolts at 1600 r.p.m.	2809.5 lb.
Stress per sq. in. at 1400 r.p.m.	5790 lb. sq. in.
Stress per sq. in. at 1600 r.p.m.	7540 lb. sq. in.

Table VIII—Crankshaft

Cylinder centres	6.690 in.
Cylinder centres (centre pair)	6.690 in.
Outside diameter of crank pin	2.165 in.
Inside diameter of crank pin	1.1024 in.
Length of crank pin	2.716 in.
Outside diameter of journals	†2.165 in.
Inside diameter of journals	1.1024 in.
Number of journal bearings	Seven
Length of journal bearings. Propeller end	2.756 in.
Length of journal bearings. Rear end	1.968 in.
Length of journal bearings. Centre	2.2047 in.
Length of journal bearings. Intermediate	2.2047 in.
Width of crank webs	2.598 in.
Thickness of crank webs	0.945 in.
Radius at ends of journals and crank pins	0.197 in.
Diameter of drilled oilways in shaft	0.1575 in.
Weight of complete shaft	72.70 lb.

†Except rear journal, which is 1.889 in. diameter.

Table IX—Miscellaneous Weights

	Lbs.
One cylinder complete less valves	26.00
Connecting rod complete	5.00
Piston complete with rings and pin	5.00
Valve complete with spring	0.992
Valve complete less spring	0.758
Valve rocker complete	0.436
Valve tappet complete less guide	0.211
Valve push rod complete	0.535
Weight of engine complete less cooling system, fuel, oil and tanks	591.50
Weight per normal, ground level b. hp.	3.70
Weight of engine complete including cooling system at 0.65 lb. ground level b. hp.	695.50
Weight per normal ground level b. hp.	4.35
Weight of engine complete including cooling system, fuel, oil and tanks for 4 hr. (fuel and oil allowance at rate of ground level b. hp. and tanks at rate of 10 per cent of fuel and oil)	1083.30
Weight per normal ground level b. hp.	6.77

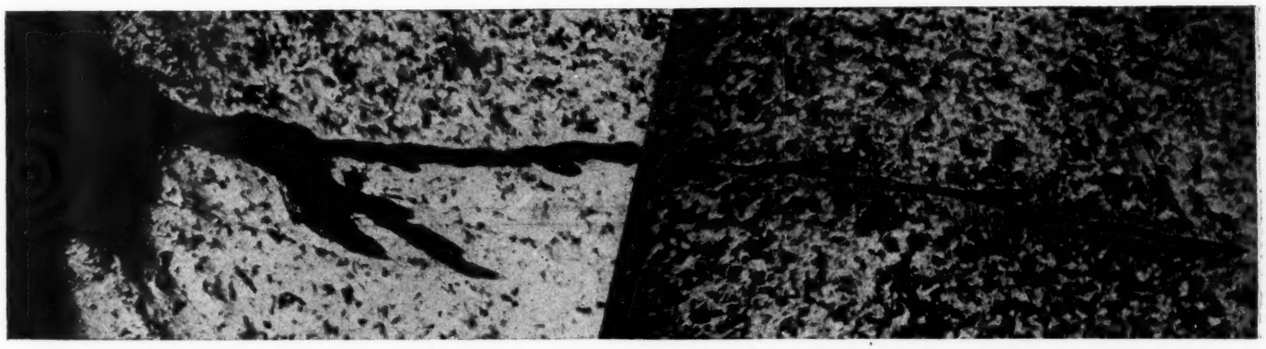
Table X—General Analysis of Weights

Description.	160 hp. Benz. Lb.	160 hp. Benz. Percentage of Total Weight	160 hp. Mercédés. Lb.	160 hp. Mercédés. Percentage of Total Weight.	Average. Percentage of Total Weight.
Cylinders	168.00	28.40	115.50	18.71	23.555
Base Chamber. Top half	100.00	16.92	118.59	19.21	18.065
Base Chamber. Bottom half	65.75	11.10	73.00	11.82	11.461
Crankshaft complete	72.70	12.28	70.00	11.33	11.806
Propeller hub, complete	12.00	2.06	13.00	2.10	2.080
Propeller thrust race, complete	3.81	0.64	2.56	0.42	0.530
Camshaft, complete	10.50	1.78	10.50	1.63	1.706
Pistons complete, including gudgeon pin	30.00	5.07	41.10	6.66	5.866
Connecting rods, complete	30.00	5.07	30.00	4.85	4.960
Valves, complete	11.91	2.01	13.68	2.21	2.110
Valve operating gear between cam and valve stem	14.20	2.40	5.94	0.96	1.680
Induction pipes, complete	8.125	1.37	11.75	1.90	1.635
Carbureters, complete	7.25	1.22	12.73	2.06	1.640
Magnetos, complete	29.00	4.91	30.00	4.86	4.886
Ignition wiring, complete with cable tubes	4.35	0.73	4.00	0.65	0.690
Water pump, complete	4.81	0.81	6.87	1.11	0.960
Water pipes	3.00	0.51	19.00	3.08	1.795
Oil pump, complete	4.55	0.77	12.00	1.94	1.355
Air pump, complete	1.125	0.19	1.50	0.24	0.215
Miscellaneous	10.42	1.76	26.28	4.26	3.005
Total	591.50	100.00	618.00	100.00	100.000

Hurried Processes Developing Faults

Microphotographs, When Analyzed, Indicate Lack of Care in Inspection Department—Some Defects May Be Traced Back to the Billet—Others Originate in the Forge

By J. Edward Schipper

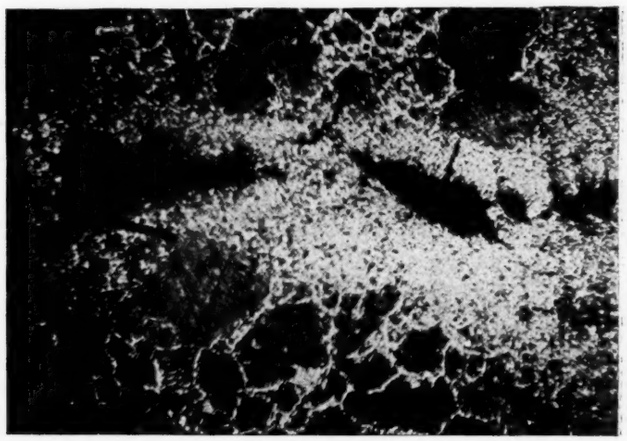


Figs. 1 and 2—Quenching crack which started from a surface crack. Probably due to shearing too closely. Nickel chrome steel, 0.40-0.50 carbon gear blank

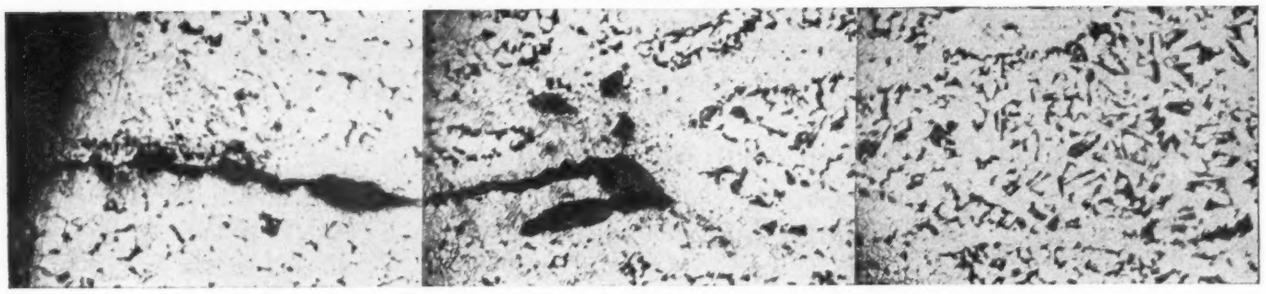
MANUFACTURERS have lately noticed a tendency toward increased defectiveness in materials. Throughout the country there has been a general speeding up in the output of all kinds of products, and sometimes this has been accompanied by a decline in quality. This is a most serious matter where the material affected is used in the manufacture of vital parts.

Defects have been found in open-hearth high and low carbon steels, as well as in some of the highest grades of alloy steels. Some of these can be traced directly to the billet, while others, especially defects in gear blanks, originated in the forge. These defects, which were practically unknown when materials were not in such strong demand as they are now, are all evidences of haste, and sometimes the old proverb that "Haste makes waste" is borne out to a marked degree in that expensive parts and operations are wasted because of hurried handling during the early stages of manufacture.

The above statements are not based on conjecture but are amply borne out by researches in the laboratory. The microphotographs shown herewith indicate defective material caused by faulty handling at different stages. Figs. 1 and 2 show a continuous crack in a gear blank of nickel chrome 0.40-0.50 carbon, heat-treated steel. We have here a case where a small crack in the surface was enlarged during heat-treating. This is what is known as a quenching crack, which started from a very small surface defect, probably caused from shearing too close under heat treatment. The line of weakness developed so that the continuous crack finally resulted. The original microphotograph is magnified 240 diameters, and the reproduction herewith reduces this to 100 diameters. The breaking area on the outside shows the edge of the blank with the crack extending inward, as indicated. Careful work in the inspection department would have caught the surface crack in the blank, and if this had been



LEFT—*Fig. 3—An example of poor material. Decarbonized area extending across center of micro due to bad mixing or insufficient cropping. This is a typical example of a pipe. Connecting-rod stock of 0.35-0.45 carbon.*
RIGHT—*Fig. 4—Crankshaft 0.37-0.47 carbon steel, showing an example of bad material*



Figs. 5, 6 and 7—Seam in a 0.15-0.25 carbon steel gear blank which could have been avoided by proper inspection and chipping while in billet before rolling into bar form

chipped out the deep break illustrated would have been eliminated, or, rather, would never have been started. This is a defect of workmanship rather than of material.

A good illustration of faulty material is given in Fig. 3. The decarbonized area is clearly shown. This is a 0.35-0.45 carbon steel connecting-rod, and the trouble is probably due to insufficient cropping or to bad mixing in the first place. The cropping percentage has been reduced from 25 per cent to 15 per cent in some instances, and naturally this gives rise to an increased percentage of defective material. It is a much more difficult thing for the metallurgist to discover every defect than it is for the steel manufacturer to stop them. This shows what the parts and car companies have to contend with in order to secure good materials under present conditions.

Another example of bad material is given in Fig. 4, where a distinct pipe is shown. The material from which this was taken is 0.37-0.47 carbon steel crankshaft stock. The magnification is 240 diameters on the original micrograph. The line of weakness with the clearly defined pipe can readily be seen on the micro.

Figs. 5, 6 and 7 illustrate a seam in a low-carbon gear blank. The carbon content is 0.15-0.25 per cent, the three micros going together in the order named. The defect in the billet has been increased by rolling into bar form, and the result is the seam, which is clearly shown in the micro. The seam has been rolled back on itself, as shown in Fig. 6, where the break area of the seam is doubled over into U form.

This could be avoided by proper inspection of the billets. If the billets were properly inspected and chipped before rolling into bars, this would eliminate the possibility of a small crack in the billet being extended into a seam in the bar. Manufacturers are avoiding difficulties of this kind by carefully supervising the workmanship and materials which they are securing. Conditions have now arisen where greater care than ever must be used in this respect, not only that the best possible product may be obtained, but also to reduce losses resulting from having to scrap material which besides being expensive in itself may have had considerable machine work expended upon it.

Liberty Worm-Driven Truck Axles

Made in Four Sizes for Trucks Up to 5 Tons Capacity—Semi-Floating Type and Fitted with M. & S. Differential

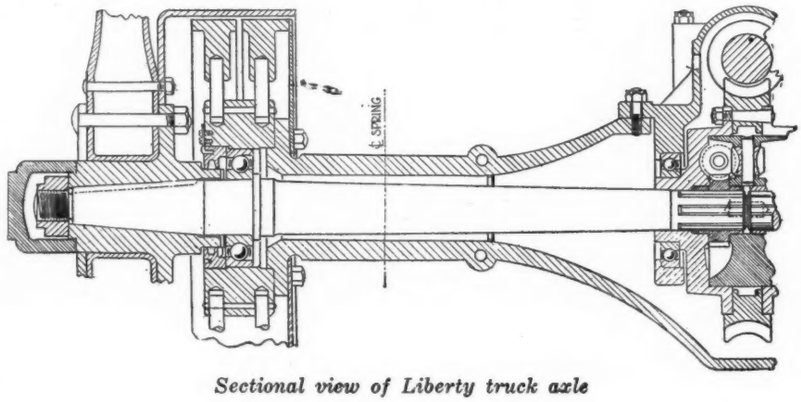
AN announcement has just been made regarding the product of the recently organized Wagner Axle Co., Anderson, Ind.—the Liberty axle. This axle is to be made in four sizes, adapted for use on trucks of 1½, 2, 3½ and 5 tons respectively. No radical features are embodied in the design, which is rather along conservative lines, incorporating only well-tried ideas. It is a worm gear axle of the semi-floating type, equipped with the M. & S. differential. The latter is of the type which makes it impossible for one drive wheel to spin, and a considerable saving in tires, as well as elimination of shaft breakage, is expected from this feature. The worm is of 3½ per cent nickel steel, the gear of special phosphor bronze and the differential case of cast steel. The differential gears rotate in an oil bath, insuring perfect lubrication.

An interesting feature is the worm carrier—a solid steel casting containing the worm gear and differential. This casting is provided with two ears so that, upon the removal of eight bolts, it can be taken out of the axle housing and any adjustment easily made.

Another feature which is thought to be a distinct advance in axle construction is the system of brakes. These brakes are of dual internal double expansion type and provide ample braking surface. They were designed for the Liberty axle.

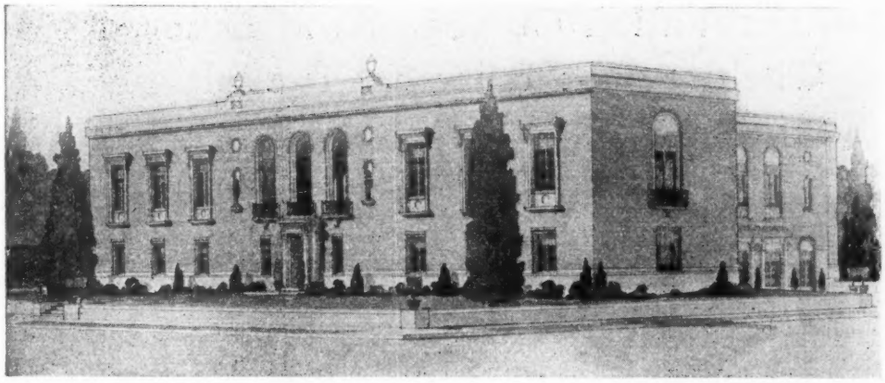
The axle shafts are made of chrome-vanadium steel and heat-treated. They are of large proportions and built to withstand the most severe usage. The bearings are of the ball type, self-aligning and capable of sustaining end thrust.

The Wagner Axle Co. was organized some time ago with a capital of $2,000,000 and has a plant at Anderson, Ind.



Sectional view of Liberty truck axle

Dayton Engineers' Club to Dedicate Newly Built Home



New club house of the Engineers Club of Dayton

AS one of the great centers of industry of the country Dayton has its engineers club, a place where men connected with the manufacturing industries in a technical capacity may meet socially. It is a live organization, having at its head a number of men of national prominence, and the automotive industries are well represented in the membership. The president of the club, Col. E. A. Deeds, is chief of the Aircraft Production Board, and is devoting his entire time to the war program. Among the vice-presidents are C. F. Kettering, the new president of the S. A. E., and Orville Wright, co-inventor of the airplane.

The membership having grown to about 300, the club felt the need for a new home. Plans were drawn up for a modern clubhouse, and the structure has been completed and will be dedicated on Saturday afternoon and evening, Feb. 2, with fitting ceremonies. Following are some of features of the clubhouse, which is conveniently located at the southeast corner of Monument Avenue and Jefferson Street facing the river. In the design of the building classical lines have been followed. It is three stories high, facing 150 ft. on Monument Avenue and 125 ft. on Jefferson Street.

The exterior is built of Bedford, Ind., limestone, and soft-toned gray buff brick laid in Flemish pattern with wide white mortar joints. The design is a strong Georgian effect giving a dignity and refinement well adapted for an engineering building.

The main entrance fronts on Monument Avenue, although there is also an entrance on Jefferson Street as well as a porte cochere entrance on the east side. Passing through the main entrance one enters a simple vestibule, which opens into a very attractive first floor lobby.

Directly south of the lobby entrance is a broad English stair leading to the spacious second floor lobby, treated in Caen stone effects, with ornamented ceiling and frieze. To the right on entering are located the secretary's office and telephone booths, and beyond is a large billiard and game room, which is provided with a large stone fireplace, English ceiling and wainscoting and cork floor.

To the left of the lobby is a broad visiting gallery at the east end of which is the porte cochere entrance. Entrances from the gallery also open to the sunken garden to the south and the large ladies' reception room carried out in the Adam period. A ladies' retiring or dressing room adjoins the reception room, while check and toilet rooms are conveniently located.

South of the lobby and down fine marble steps is the dining-room foyer, with checking facilities, and entrance to the sunken garden to the east and Jefferson Street to the west.

Directly south of this foyer is the main dining-room, off which open eight private dining-rooms, all of which may be thrown together with the main room, making a large room for banquet purposes. South of the dining-room is a spotless white serving-room and kitchen, provided with the latest improved equipment for efficiently handling the service of the club.

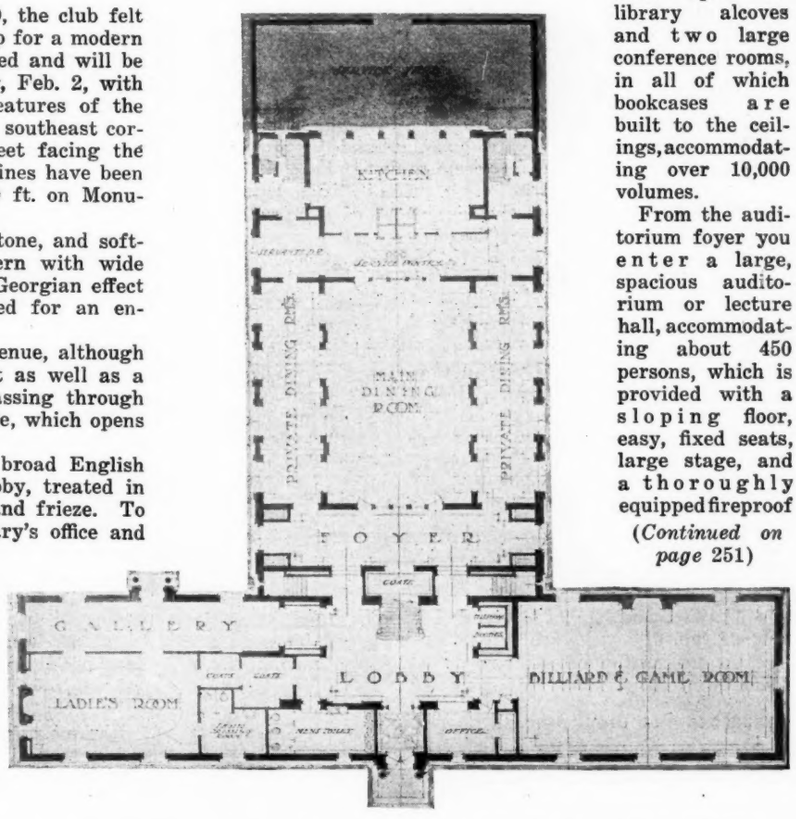
From the second floor lobby above referred to open a large loggia to the north, large lounging room to the west, library and conference rooms to the east, and an auditorium foyer to the south.

The lounging room, located directly over the billiard room, is 30 x 50 ft., with a large stone fireplace on the south side, high English wainscoting and heavy wood beamed ceiling, all kept in soft quiet coloring, making a restful atmosphere.

Just east of the lobby is located a large library and reading room, off which open two library alcoves and two large conference rooms, in all of which bookcases are built to the ceilings, accommodating over 10,000 volumes.

From the auditorium foyer you enter a large, spacious auditorium or lecture hall, accommodating about 450 persons, which is provided with a sloping floor, easy, fixed seats, large stage, and a thoroughly equipped fireproof

(*Continued on page* 251)



Floor plan of ground floor of the new club house of the Engineers' Club of Dayton

Fuel for Automotive Apparatus*

Straight Refinery Gasoline, Cracking Process Products and Blended Fuels — Distillation Curves of the Different Fuels and Their Adaptability to Present Day Engines—Production Figures

By Dr. E. W. Dean
Petroleum Division, U. S. Bureau of Mines

THE present paper deals with certain mutual problems of the two industries of automotive engineering and petroleum refining. A brief preliminary discussion seems to be in order to explain why a chemist is elected to present information apparently not related to his normal field of work.

The Bureau of Mines has for several years been conducting scientific investigations in the field of petroleum technology. This work was begun through the establishment of a chemical laboratory for the testing of oils. It was, however, recognized at an early date that little of practical importance could be accomplished if activities were limited to such a narrow scope. When the present petroleum division of the Bureau was organized the chemical section of this division was made to include with its laboratory investigations studies in the fields of petroleum refining and utilization.

The Bureau was early impressed with the general failure of producers and users of petroleum products to work together in dealing with the many problems that are of mutual interest. It is now thought that no more important end can be accomplished than to interest refiners and automotive engineers in the advantages of co-operation.

The principal petroleum products in which automotive engineers are interested are gasoline and lubricating oil. At present the latter does not seem to demand as much attention as the former, and although there is little doubt as to the advantages to automotive engineers of a knowledge of the manufacture and properties of lubricants, it seems most desirable at present to concentrate efforts on the obtaining of a solution of the fuel problem.

Gasoline Problem of Chief Interest

During the past few years the demand for gasoline has increased far more rapidly than the supply of raw material from which it is produced. Consequently there has been a general change in refinery practice with the production of so-called heavy gasolines, which are actually of relatively low average volatility. Although this change in quality is not necessarily deterioration, it has brought to the attention of designers and users of internal combustion engines problems that did not exist in the past. Coincident with the change in quality there has been an increase in market price and a threatened condition of shortage in supply, so that the automotive engineering industry now has for solution the complex problem of devising equipment for the utilization of fuel of low volatility and at the same time getting a greater production of effective power from the quantity of gasoline used.

Properties and Production of Gasoline

Before beginning the most important part of this paper—that which discusses the possibilities of increasing the supply of fuel and the efficiency of its utilization—it is desirable to consider briefly the characteristic qualities of gasoline and the possibility of variation among these as influenced by refining methods. It is already understood by automotive engineers that the name gasoline is decidedly indefinite in its meaning and that it includes a heterogeneous class of petroleum products that have in common only the power of enabling automobilists to start and operate their engines. The following discussion is intended to show some of the characteristic differences among types and grades of gasoline and to explain and perhaps justify the changes in quality that have occurred recently.

Review of Refinery Methods

There are now three general methods by which gasoline is obtained from raw material. The oldest and still the most important is the ordinary refinery process of distillation from crude petroleum. A second method, also used in refineries, is the pressure-cracking process, in which, instead of crude petroleum, heavy distillates, such as gas oil or fuel oil, are used as raw material. The third method involves the extraction of gasoline from natural gas, either by the absorption or the compression process. The product thus obtained is commonly called casinghead gasoline.

An adequate discussion of the details of any one of these processes is beyond the scope of the present paper, and it is therefore necessary to pass this interesting field with a brief word of mention. It may be stated, however, that the straight distillation method is highly developed and that improvements in it offer only moderate possibility of increasing the supply of fuel. Some gasoline and naphtha still goes into the kerosene fractions, but wastes of this sort are not important in the present situation. The cracking process is as yet only partly developed, and in the future its use will undoubtedly be considerably increased. It is not to be expected, however, that there will be more than gradual development in this field even if the Standard Oil Company should decide to license the Burton process for general use at an early date.

Other cracking processes are being installed on a commercial scale, but as yet seem to be limited to the small unit stage. The extraction of gasoline from natural gas is likewise a method that is growing in use, and it is difficult to predict just what can be expected from it on the basis of data now at hand. The recently developed absorption process makes it profitable to extract gasoline from gas not sufficiently rich to be treated by the compression process, but resources in this direction probably cannot be expected to develop in more than gradual fashion.

Properties of Straight Refinery Gasoline

The most familiar type of fuel, that produced from crude oil by the distillation method, is commonly described as "straight refinery" gasoline. This type of gasoline, as ordinarily refined, is colorless and possesses an odor varying from actual sweetness to the slightly disagreeable quality characteristic of kerosene. The hydrocarbons of straight

*Paper read at the S. A. E. winter meeting.

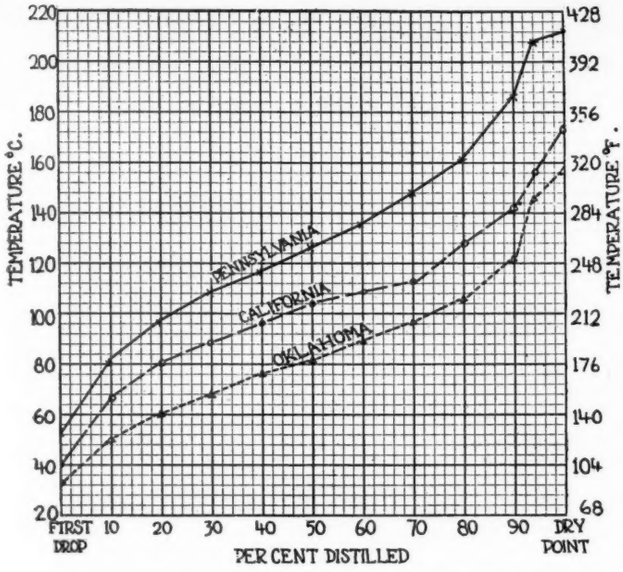


Fig. 1—Showing similarity in form of distillation curves of straight refinery gasolines of different degrees of volatility and from different parts of the country

refinery gasoline are of the so-called saturated class and are inactive when treated with such reagents as bromine, iodine and cold concentrated sulphuric acid. They are, however, slightly attacked by fuming sulphuric acid of moderate strength and by nitric-sulphuric acid mixture.

Straight refinery gasoline may vary within wide limits in the property of volatility, but the distillation curves obtained by plotting the results by the Engler test have a more or less characteristic form. Fig. 1 shows the distillation curves of three gasolines of various degrees of volatility obtained from different types of crude petroleum. The percentage marks are plotted as ordinates and temperatures as abscissas. The curves slope upward rather sharply from the initial boiling point to approximately the 20 per cent mark. From this point the graph proceeds as practically a straight line sloping gradually upward to about the 90 per cent mark. Here another steeper slope commences, which generally proceeds to about the 95 per cent mark, and then breaks sharply. This break is due to the fact that the dry point is not actually the 100 per cent mark.

Gasoline from Cracking Processes

The characteristic properties of cracked gasoline are odor and content of unsaturated or olefin hydrocarbons. Untreated cracked distillates have a particularly rank and unpleasant odor, which can, however, be practically eliminated by treatment with a small percentage of sulphuric acid. The odor of a well-refined cracked gasoline is not noticeably disagreeable, but has a definite quality and pungency that distinguishes it from gasoline of the straight refinery type. This odor is admitted to be somewhat undesirable, but is not a serious objection. The other characteristic property of cracked gasoline is a considerable content of unsaturated hydrocarbons, compounds that react with such chemicals as bromine, iodine or concentrated sulphuric acid.

The amount of material removable from the gasoline by treatment with an excess of cold concentrated sulphuric acid is generally called the percentage of unsaturation. The cracked gasolines usually marketed are acid refined and blended with straight run and casinghead products and generally do not contain over six per cent of hydrocarbons removable by sulphuric acid. The volatility curves of cracked gasolines are, like those of straight-run products, controlled by the method of refining, but the characteristic general form is the same as for the refinery distillates. Fig. 2 shows the distillation curve of an unblended cracked gasoline compared with that of a straight refinery product that happens to be of the same average volatility. The form of the two curves is almost identical.

Natural gas gasoline is of such a volatile nature that it is usually blended with a considerable proportion of heavier gasoline to reduce its vapor pressure so that it can be shipped and used safely. Its chemical and some of its physical properties are identical with those of the straight refinery type of product. It is colorless, of sweet odor, and inactive with sulphuric acid, bromine and iodine. The volatility of unblended casinghead gasoline is a property concerning which the Bureau has few data. This product is rarely used as such except perhaps in gasoline gas machines. It is usually marketed as a blend, either with a heavy naphtha produced by the ordinary refinery process or with straight refinery gasoline of high endpoint.

The term heavy naphtha is used to designate a distillate which does not contain the low boiling fractions included with ordinary gasoline. The blending of casinghead gasoline with the straight run product is generally done in refineries, many of which make a practice of buying all of the former they can obtain and adding it to the distillates produced from crude petroleum. The blending of casinghead gasoline with naphtha is generally done either by the companies that produce the former from natural gas or else by blending companies.

Desirable Properties of Gasoline

The desirable properties of gasoline and some laboratory tests and specifications for determining them have been discussed in a recent technical paper published by the Bureau of Mines. This paper was intended chiefly for the information of refineries and chemists but a brief review of some of the considerations mentioned may not be out of place here.

The requirements for a satisfactory fuel are as follows:

1—That it shall permit ready starting of a cold engine;

2—That it shall permit smooth and reliable operation of an engine at varied and rapidly changing loads and speeds;

3—That it shall not contain substances such as free acid which by corrosion or otherwise injure an engine;

4—That there shall be a minimum tendency for either solid or liquid residues to accumulate in the engine.

It is also desirable that gasoline shall not be of such nature as to be subject to excessive evaporation losses in storage or handling and that it shall not be too dangerous. These latter requirements are indefinite, however, and vary with climatic conditions. In addition they are likely to interfere with the starting qualities of gasoline if satisfied too thoroughly.

The second and third requirements are generally satisfied by present refinery practice. The Bureau has heard no complaints either of corrosive action due to free acid in gasoline or of lack of flexibility in engine operation. The first requirement, easy starting of cold engines, seems to be least generally met as the present tendency of refineries is to

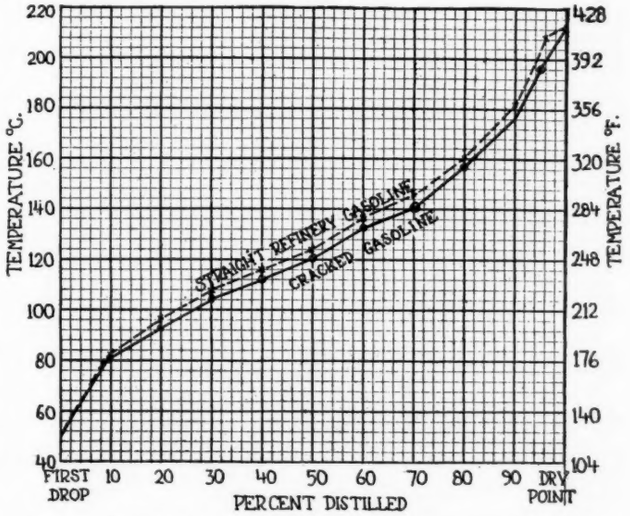


Fig. 2—Showing similarity in the distillation curves of cracked and straight refinery gasolines. Upper curve represents a straight refinery gasoline produced in Oklahoma—lower curve an unblended cracked gasoline produced by the Rittman process

market gasoline of relatively low average volatility. There seems to be little possibility of improvement in this quality and the problem of easy starting will undoubtedly have to be solved by engine designers.

The requirement that gasoline shall not leave a solid or liquid residue in the engine is one that frequently is not satisfied, according to reports from many makers and users of engines. Complaints are heard to the effect that there are sometimes gummy deposits in carbureters and manifolds, that excessive carbon deposits collect in cylinders, and that heavy fractions of gasoline are unburned and forced past cylinder rings into the crankcase oil. Difficulties are without question frequently due to improper engine adjustment and operation, but the gasoline is undoubtedly to blame in some cases. The accumulation of gummy deposits in carbureters and manifolds is a type of trouble for which there does not at present seem to be any definitely established explanation. The Bureau is at present studying this problem but has not yet enough information at hand to make it desirable to attempt an adequate discussion. Fortunately this type of engine trouble does not seem to be of frequent occurrence.

The two most important types of residue are carbon, which collects in the explosion chamber, and heavy fractions of the gasoline that condense and escape past the piston rings into the crankcase. Carbon deposition is frequently due to improper carbureter adjustment and can generally be minimized if a sufficiently lean mixture is used. Such deposition is, however, in common with crankcase oil pollution, often due to the use of gasoline containing too great a proportion of heavy ends, which in everyday language means kerosene. The term used by the refiner and oil chemist is "high endpoint" and means that when the gasoline is subjected to a distillation test the presence of high-boiling fractions is indicated. These fractions undoubtedly are not vaporized even in cases when no fuel troubles are experienced but are burned while in the form of a fine spray, in the same way that coal dust or grain dust burns explosively.

Fuel trouble due to high endpoint occurs when heavy constituents are present in excessive proportion; so that instead of holding up in spray form drops of considerable size precipitate. These settle on cylinder walls and piston heads and cause trouble in a variety of ways. Lubrication is interfered with, there is deposition of carbon through cracking and liquid residues may be forced past the piston rings and mixed with the lubricating oil. There may be other ways in which trouble is caused but those already mentioned are sufficient to indicate the disadvantage attendant upon the use of gasoline of too high endpoint in the average engine.

Unfortunately it is a difficult matter to set any kind of a definite limit that serves to indicate when the danger line in endpoint is passed. There are on record cases that seem to indicate that trouble has been caused by the use of gasoline of endpoint lower than 400 deg. Fahr. On the other hand a tremendous quantity of gasoline is being used, generally without more than imaginary fuel trouble which has an endpoint as high as 450 deg. In some cases 500 deg. endpoint gasolines are satisfactorily employed and the author is acquainted with one man who during the summer months regularly mixed with his gasoline a fourth of its volume of kerosene and obtained satisfactory results.

There is no question upon which it is easier to start an argument than on the proper endpoint of gasoline. The Bureau of Mines has up to date taken the stand that the only evidence it could depend on is the general marketing practice of refiners and on this basis it appears that the maximum satisfactory endpoint for a properly balanced gasoline is between the limits of 400 deg. and 450 deg. Fahr.

Objections to Blended and Cracked Products

There is still a tendency on the part of some users to consider that the only desirable variety of gasoline is a highly volatile product obtained by the straight refinery method. Blended casinghead gasolines are claimed to be dangerous, to deposit carbon and to stratify or change their composition in different parts of a storage system. Cracked gasolines are believed to be of vile odor and to polymerize in carbureters and manifolds and to leave excessive carbon deposits in cylinders. Straight refinery gasolines of high endpoint are likewise condemned on the ground that they are bad in starting an engine and that they deposit carbon and pollute the crankcase oil.

These beliefs are not without some foundation of fact. There is little doubt that from the point of view of the average user the most satisfactory fuel ever produced was a straight refinery gasoline testing 70-deg Baume or higher. This type of product was relatively dangerous in handling and was subject to high evaporation losses; but these disadvantages were ones to which users of the past were educated and which were considered characteristic of gasoline. The fact that gasoline was treated with proper respect minimized in a large degree the first disadvantage and its relatively low cost minimized the second. Gasoline of this type worked satisfactorily under almost any sort of engine conditions and in any event was rarely blamed for trouble. In earlier days the custom when anything went wrong was to swear at the engine rather than at the fuel.

When the newer types of gasoline were first introduced the trouble and dissatisfaction that immediately arose was not without some just cause. In many cases the process of blending casinghead gasoline was not properly conducted and in any event 70-deg. Baume gasolines of this type could not help being dangerously volatile. Methods of refining cracked gasoline were not perfected when these distillates were first marketed and they certainly did not compare favorably with straight run products in the matter of odor. It is likewise possible that there may actually have been cases of polymerization with troublesome deposition of gummy resinous material. When heavy straight refinery gasolines were first used engines were not designed or adjusted for their consumption and difficulties naturally arose. At present the methods employed in production and refining have been so improved that the bulk of the gasoline now on the market is really of excellent quality.

Cracked and Natural Gas Gasolines

Both cracked and natural gas gasolines are put out in the form of blends that the average user cannot distinguish from straight refinery products and which have actual elements of superiority over the latter as now marketed. Heavy gasoline is, of course, deficient in the property of easy starting, but this objection is balanced by the fact that it actually contains more heat units per gallon and permits the development of more power. There are certain other admitted objections to relatively non-volatile gasolines, but these are chiefly of the sort that can be obviated by proper engine design and adjustment. The Bureau has yet to receive proof that a gasoline of 400 deg. Fahr. drypoint and a properly balanced range of volatility (which means that from 15 to 20 per cent of constituents distil below the boiling point of water and that the other fractions are reasonably evenly distributed) has failed to yield satisfactory results in a well adjusted automobile engine of up-to-date design. In many cases gasolines of as high endpoint as 450 deg. Fahr. are being used with satisfaction.

The main advantage of the present type of fuel is that its introduction has permitted the producers to keep pace with the demands made upon them. If the older standards of quality had been maintained prices would have soared far above their present high level and in addition there would have been to-day an actual shortage. Few users of automobiles would prefer limitation in their supply of fuel to the slight inconvenience of having to treat their engines with the care and respect these complicated mechanisms actually deserve.

It is a difficult matter to make accurate predictions for the future of a situation involving as many variables as does the automotive fuel market. The Bureau of Mines is able to obtain reliable information concerning gasoline production and quality but realizes its inability to foresee all factors governing market conditions. It is therefore necessary to be conservative in attempting to tell what is likely to happen in any limited region or at any given time.

The one definite prospect for the immediate future is that there will be a considerable withdrawal of fuel from the home market for use in military operations. The quantity needed

can be conservatively estimated for the present calendar year at about a fifth of the total production of the country. There is a likelihood that the quality will also be changed in the direction of further decrease in volatility because gasoline for military purposes will necessarily be of higher test than the present average commercial grade. If the total production is to be kept up to the present market this will mean that domestic gasoline will be of lower volatility than now. In addition, refiners may be obliged to curtail their use of sulphuric acid, which will result in the marketing of gasoline of inferior color and odor.

The fuel situation is unfortunately one for which the ultimate successful termination of the war does not promise permanent relief. Estimates as to the number of years our resources of crude oil will last have been variously made and it is agreed that unless unexpected resources exist another generation will witness an actual shortage in the raw material from which gasoline is now produced. It is certain that the world cannot go on forever using up crude petroleum at the present rate of consumption and it is even now desirable to face this prospect squarely and make allowances for what the future is likely to bring. The possibilities of new supplies of fuel will therefore be discussed briefly, with the idea of showing the relative importance of the sources of relief mentioned.

Use of Alcohol

When looking for a future supply of any product it is natural to consider raw material that can be continuously produced instead of taken from a stored-up deposit. Alcohol is a volatile liquid fuel that is known to be satisfactory for use in internal combustion engines and which can be produced by the simple process of fermentation from any source of sugar. Unfortunately, however, evidence is still lacking that alcohol can be produced sufficiently cheaply enough to compete with various other forms of fuel that come to us as it were ready made. Just at present alcohol sells at a price that almost prohibits its use even as an anti-freeze compound. This situation is of course abnormal and there is every prospect that in the future alcohol may be on the market at a lower price than ever in the past.

The economical utilization of alcohol requires, however, engines that operate at compression pressures far greater than now employed for gasoline, which fact introduces complications that relegate alcohol to the far distant future as a potential substitute for gasoline. For the present it seems that alcohol is only of academic interest as an engine fuel except perhaps in localities where gasoline is expensive and scarce and the most promising raw material for alcohol manufacture is cheap. Such a situation already promises to develop in the Hawaiian Islands; gasoline is obtained there only after shipment over sea, but low grade unrefinable molasses is produced in large quantities.

Use of Coal-Tar Distillates

Another source of fuel that has received much attention is the by-product coking industry. The light oil constituents obtained by this process, such as benzol, toluol and xylol, are known to be satisfactory fuel, and although during the war the demand for them will continue to be greater than the supply, they will undoubtedly be marketed as fuel after the present abnormal production of explosives decreases. The use of these hydrocarbons either as such or blended with petroleum gasoline may increase the supply of fuel to a certain degree, but unfortunately the total available supply is relatively small. The following statistical information is interesting: The gasoline production of the United States for the calendar year 1916 has been variously given at from 2 to 2¼ billion gallons. The U. S. Bureau of Mines report on refinery operations for the year 1916 gives 2,058,880,596 gal. This includes a portion of the production of casinghead gasoline, which has been given as 104,212,809 gal. by J. D. Northrup, U. S. Geological Survey press bulletin No. 332 (August, 1917).

The production of coal-tar light oils for the same year was 36,600,000 gal. (C. E. Lesher, *Iron Age*, Vol. 99, Feb. 22, 1917), and it has been estimated that during the year 1917 this production will have been increased to from 40 to 60 million gallons. These figures indicate that if the total production of coal-tar light oils of the country were added to the engine fuel supply the increase would be about 2 per cent. These figures represent coking operations already conducted by the byproduct method. Figures based upon the total coke production of the country and even the total coal production of the country are not much more promising. The total coke produced in 1916 by both beehive and by-product ovens is given as 54,533,585 short tons and the total bituminous coal as 502,519,682 tons. (United States Geological Survey press bulletin No. 343, November, 1917). It is likewise recorded that the average yield of coke from a ton of coal is 1440 lb. and the average yield of light oil is 1.54 gal. (C. E. Lesher, Mineral Resources of the United States (1916) part 2, pp. 515-558).

Calculations from these figures indicate that if all the coke produced in the country in 1916 had been made by the by-product process the 75,741,053 tons of coal used would have yielded 117,641,232 gal. of light oil, which if entirely devoted to use in internal combustion engines would have increased the available supply of fuel by a little more than 5 per cent. If all the bituminous coal produced had been coked and had yielded the same average quantity of light oil as the grade of coal now used for coking the light oil produced would have amounted to 753,779,523 gal., which proves to be

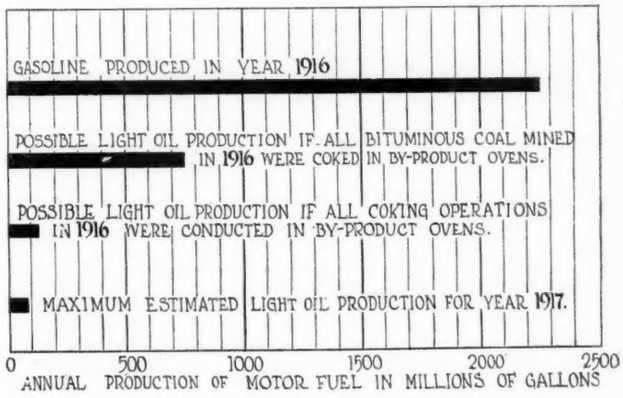

GASOLINE PRODUCED IN YEAR 1916
POSSIBLE LIGHT OIL PRODUCTION IF ALL BITUMINOUS COAL MINED IN 1916 WERE COKED IN BY-PRODUCT OVENS.
POSSIBLE LIGHT OIL PRODUCTION IF ALL COKING OPERATIONS IN 1916 WERE CONDUCTED IN BY-PRODUCT OVENS.
MAXIMUM ESTIMATED LIGHT OIL PRODUCTION FOR YEAR 1917.
0
500
1000
1500
2000
2500
ANNUAL PRODUCTION OF MOTOR FUEL IN MILLIONS OF GALLONS

Fig. 3—Showing relative magnitude of present annual gasoline production of the United States and the additional quantities of motor fuel available from the distillation products of coal

less than 34 per cent of the gasoline production. These statistics show the limitations of the coking industry as a source of engine fuel. Fig. 3 represents graphically the theoretical quantities of fuels produceable from coal as compared with the gasoline actually produced. The use of coal-tar light oils as fuel will undoubtedly aid to increase the supply at some time in the future but they by no means promise to meet the total need for more gasoline.

It is by no means certain that tremendous quantities of crude petroleum exist that are not at present counted on, and producers are hopeful that such fields as the Mexican and even the Central American and South American fields may ultimately develop to a considerable degree of importance. The discovery of more crude would seem to be the easiest and most pleasant way of meeting the threatening fuel shortage, but this is a possibility that is so uncertain that it is hardly wise to place dependence on it.

Gasoline from Oil Shale

Vast deposits of oil bearing shale are known to exist in certain parts of this country and engine fuel can undoubtedly be obtained from this source. Here, however, as in the case of alcohol, the factor of expense in producing puts these products in the class of a resource that may be utilized in the future. Scientists are already giving attention to the problem of working up these shales and it is hoped that satisfactory methods for obtaining engine fuel in maximum quantity and of the best possible quality will be developed by

the time it becomes commercially practicable to use these shales. Many problems in the fields both of distillation of the shales and treatment and refining of the oils remain yet to be solved, but these problems are considered to be comparatively simple of solution and are now being studied.

From the point of view of the oil refiner the most desirable way of increasing the supply is to get more of it from the same quantity of crude oil now refined. This can be accomplished either by extending the range of volatility acceptable for fuels or by the employment of methods that increase the quantity of volatile products obtainable from the crude. The latter possibility is that which the use of the cracking process covers. The development of these processes is to-day the most important field of experimentation in the industry and considerable progress has already been made. The Burton process, owned and controlled by the Standard Oil Company of Indiana, and operated by various of the companies of the Standard group, has been developed to a high degree of efficiency and is regularly converting large quantities of heavy petroleum distillates into satisfactory fuel.

The Hall process, which is said to be operated on a large scale in England and to some degree in the United States, is also apparently in the stage of successful commercial operation. The Rittman process, with which the Bureau of Mines has been largely concerned, seems now to be thoroughly developed for the large scale production of gasoline and should soon be a commercial factor in the market. Other processes now operating are the Greenstreet and the Cosden.

Burton Process

At present it appears that the Burton process and others of the pressure distillation type can operate successfully using as raw material fairly heavy petroleum distillates, such as the fuel and gas oil types. The Burton process cracks a limited amount of kerosene also but it is not adapted in its present stage of mechanical development to the treatment of oils of this type. The Rittman and Hall processes are said to operate equally well with kerosene and the heavier distillates. The Greenstreet process seems to operate entirely with kerosene distillate. It is not known that any pressure cracking process is successfully utilizing oils of the residuum type in large-scale apparatus. These crack readily enough, but the mechanical difficulties incident to the deposition of large quantities of carbon have so far interfered with commercial success.

The general consensus of opinion of those qualified to judge is that the production of volatile hydrocarbons, satisfactory for use as engine fuel, can be brought about by many modifications of the principle of applying heat and pressure but that the cracking process in general cannot be made a commercial success unless handled with a high degree of scientific and technical skill and under carefully regulated economic conditions. In other words, although oil is easy to crack it is not easy to crack profitably. The oil cracking art is in many ways like the poultry business. Any amateur can convert grain and meat scraps into chickens and eggs but it takes more than interest and ambition to accompany this process by the accumulation of financial profit. Likewise, it is tolerably easy to make gasoline out of heavy oil but a totally different matter to keep the cost of the finished product satisfactorily below its market price.

It appears therefore that although the cracking process offers great possibilities of increase in the supply of fuel, this increase is bound to be in the way of a gradual development and in no way revolutionary. It is possible that if cracking processes were used to the full extent of their applicability the total production of gasoline from the quantity of crude oil now produced might be doubled. This increase cannot however be expected on the basis of reasonable possibility in less than ten years.

An adequate discussion of cracking processes would require more time than automotive engineers would wish to devote to even this vital subject and for the present the situation can be summarized by stating that this method of increasing the fuel supply seems just at present to be considerably more important than any or all of the possibilities discussed.

The possibilities of increasing our future supply of fuel have already been discussed from the points of views of several industrial divisions. It has been shown that the men in the producing end of the oil industry may help solve the problem by making available new supplies of crude petroleum. Scientists have the problem of making available the supply obtainable from oil shales.

The coal distillation and the fermentation industries may in the future supply greater or less quantities, and the refiners by the improvement of their present methods and the development of cracking processes can contribute enormously to the country's production. There remains for discussion the part that designers and builders of internal combustion engines have to play in increasing the potential supplies.

Increase in Engine Efficiency

It may seem presumptuous for a rank outsider in the gasoline engine business to suggest that one of the most important lines of activity for automotive engineers is to increase the potential efficiency of the engines they turn out. It actually seems, however, that there are tremendous possibilities in this line, not necessarily through increases in mechanical efficiency but by educating the public to demand and use automobiles that are essentially economical in consumption of fuel. There are now on the market types of cars that on average roads and grades can travel about 20 miles on a gallon of gasoline. Most of these cars are of low and moderate price and it appears that the majority of higher-priced cars get notably less mileage, this in some cases being as low as 6 or 8 miles per gallon.

Such a condition should not continue because if fuel, at any price, is not going to be available, the automobile business is bound to suffer. For this reason it seems that the designers and manufacturers ought to take this matter in their own hands, regardless of the present demands of buyers, and work out a reasonable standard of performance for all cars. For instance, cars might be built with the basic assumption that a two- or three-passenger car must travel 22 miles on a gallon of gasoline, a five-passenger car 18 miles and a seven-passenger car 16 miles. Some such standard of efficiency as this should be regarded as ironclad and all automobile design based upon it. Such considerations as speed and hill-climbing power should not be allowed to interfere with this matter of efficiency and the users will soon get over the idea that it is necessary to have 80-hp. engines in their cars when 30 hp. is sufficient to carry them at adequate speed anywhere they want to go.

Use of Less Volatile Fuels

Perhaps no phase of the fuel situation has so interested automotive engineers as the use of kerosene in place of gasoline. Present market conditions are such that kerosene is one of the cheaper petroleum products, and as it has already been demonstrated to work satisfactorily in internal combustion engines under certain conditions there has been a great desire to render it available for general use in automobiles. The Bureau of Mines has had called to its attention many devices for the utilization of kerosene but believes that mechanical development in this particular line is a mistake. The logical and reasonable way to utilize kerosene is not as such but as a mixture with the gasoline produced with it in the refining of crude oil. In other words, attention should not be given to the utilization of kerosene but to the utilization of petroleum distillates containing both the gasoline and kerosene fractions of crude oil.

In terms of the testing laboratory this means fuel of high endpoint and correspondingly lowered average volatility. Such fuels could be produced by the refiners with slight modification of their present methods and equipment, and their price should be somewhat less than the average price of gasoline and kerosene now marketed separately. The gain would be the simplification resulting from the production and handling of one instead of two products. The Bureau is not attempting to tell just how the problem of designing engines that can handle fuel of from 550 to 600 deg. Fahr. endpoint can be solved, but accomplishment of such an end ought not to be beyond the skill and ingenuity of engine designers, especially as they have already seriously undertaken the infinitely more difficult task of using straight kerosene.

(*Continued on page* 251)

No Spares on French War Trucks

Taxi System of Spares as Repairs in Truck Convoys Considered Best

By W. F. Bradley
Special Automotive Industries Correspondent

PARIS, Dec. 27—Even in technical quarters the impression prevails that army automobiles should be sent forth equipped with a stock of spares calculated on the basis of the requirements of an isolated car going on a trans-continental trip. Thus the suggestion is frequently made that the standard equipments should include spare valves and springs, brake liners, magneto and carbureter parts, gaskets, fan belt, etc. When the first taxicab services were started the cars were sent out with a very complete collection of parts. It was discovered that these parts were lost, broken, or ruined by rust; or if they were kept in condition the drivers did not possess the knowledge necessary to use them.

War Truck Drivers No Experts

War conditions have been similar. The average truck driver in the European armies is no better than the average taxicab driver. Although America has good raw material at her disposal, and has not actually had to train drivers on a big scale as it is done in England and France, the average technical ability of the men she is putting, or will have to put, on her trucks is not very much higher than that of her European allies.

At first sight the suggestion to send trucks forth on war service without any spare parts appears drastic: it is a suggestion which invariably meets with the opposition of skilled and experienced drivers, who being themselves capable of carrying out repairs consider that other men can do so also. The case is being considered of trucks working in convoy formation, or, if running isolated, being attached to some permanent group, and not of staff cars which are always more or less independent and away from a permanent base. On truck service, then, it may be taken that 80 per cent of the spare parts given out to be carried on the vehicles will either be lost or rendered useless at the end of 6 months.

Lists of parts are made upon the assumption that these particular parts will either break or wear out and will be needed to enable the car to finish its journey. Thus the most commonly accepted lists comprise fan belt, carbureter float, magneto carbons, brake liners, valves with springs and cotters, driving chains, gaskets, etc. Some makers and some military authorities have proposed the inclusion of ball bearings and clutch plates. Not one enlisted driver in a hundred is capable of replacing a ball bearing or taking down the clutch on the roadside. Even if they could do this it is more economical to get a tow home and carry out the job with the conveniences of a field workshop. Assuming that the list of parts is selected with the greatest care, it is probable that the greater percentage of the cars will be held up by the failure of some part which is not included in the equipment. The more complete the collection the greater the risk of loss and damage and

It has been proved entirely practical to send fleets of trucks into the field with no other parts than four plugs and gaskets, a few split pins, wire and adhesive tape. Indeed, carefully considered, this is all that any car or truck working with a group really needs for active service. The tool kit should be complete and should include all special wrenches for dismounting and adjusting any part of the car. There should be oil cans, syringes, funnel, a reserve of gasoline, oil, grease and kerosene; a collapsible water bucket should be on hand, but on most portions of the European front water is so plentiful that it is useless to carry it around. In making this recommendation it is being assumed, of course, that the motor is reasonably well cooled.

There are on war service in Europe thousands of trucks which individually do not carry any spare parts. They give good and reliable service without parts, and their operating cost is lower than if these parts were supplied. Such a system is only possible, however, with a really competent and energetic officer at the head of the column. It is a more difficult matter than is generally imagined to make automobile drivers give to their cars and trucks the attention necessary to keep them in good running condition. Unless kept under strict control the average army driver will not clean out oil filters, screw down grease cups, watch for loose nuts, take care of his battery, lubricate his universals, and do the other minor duties which are not repairs, but are essential if the car is to give continued satisfactory service. Responsibility for all this devolves on the officer in charge of the column or section; if he watches these points carefully the service will be good; if he neglects them the service is bound to be poor.

Supplies in Charge of Column Mechanic

Truck columns working on the principle of no spare parts aboard the individual trucks carry a stock of supplies in charge of the column mechanic. This stock comprises details such as bolts and nuts, split pins, spark plugs, gaskets, rubber hose, and the following:

- 1 magneto
- 2 radiators
- 8 valves complete with springs
- 16 valve cap gaskets
- 8 piston rings
- 2 connecting-rod bolts
- 2 carbureter jets
- 1 carbureter float
- 1 fan belt
- 2 fan belt fasteners
- 1 fan bearing
- 1 rear spring
- 1 front spring
- 2 rear-spring shackle bolts
- 2 front-spring shackle bolts
- Greasers

The parts are carried aboard a covered two-wheel trailer which travels with the column and remains at the column headquarters. Thus this trailer only covers a fraction of the mileage of any of the trucks, for it merely changes its quarters when the column moves its base. The mechanic attached to the column is personally responsible for this stock of spare parts and can be called on at any time to show what he has done

with them. The mechanic renews his supply from a park which is responsible for the maintenance of approximately 12 columns, or 240 trucks. The park gets its renewals from the base.

It has been found possible to considerably reduce the total number of truck and car parts kept in stock for vehicles on war service without any loss in efficiency. Thus a certain high-class American truck is composed of 1205 individual parts, according to the maker's parts catalog. One of the European forces has reduced these parts to 402 by refusing to stock such parts as are never known to break, or which are of such a nature that they can be made cheaper than they can be imported.

To give a few examples: Running-board brackets are eliminated; fenders, running boards, tops, subframe members, lamp brackets, are all considered unnecessary. Many bolts, nuts, washers, etc., common to all makes are cut off the list. Minor controls are eliminated. If any unit in the field sends in a request for one of the 603 parts not stocked because considered unnecessary, the applicant is informed that the part can be obtained on special order from America, and that delivery will be made in 6 months' time; under the circumstances it is intimated that an attempt should be made to make this part in the field workshop. Invariably the applicant discovers that he can make the part.

If true economy is to be studied, it is impossible to draw up a general list of parts to be stock and apply that list to all makes. Under European experience the parts stocked in the military bases, these parts, as already stated, comprising only about one-third of the parts figuring on the makers' catalog, are carefully studied for each make of truck and differ considerably in their details. To give a few instances without mentioning any names:

One truck is liable to fractures of the water collector on the head of the cylinders, while on another these are never known to break.

Truck A burns up valves occasionally and breaks springs.

Truck B, which is equipped with spare valves, hardly ever breaks or burns one.

Truck C has poorly designed water spaces around the valve seats and cracks cylinder from time to time.

Truck D—no cylinder ever has cracked except from frost.

Truck E, by reason of a peculiarity of its oil system, is liable to burn out one of the connecting-rod bearings.

This never happens on Truck F.

Truck G has a very powerful transmission brake and under its influence unskilled drivers sometimes strip gears.

Truck H breaks driveshafts from time to time.

A certain model touring car is liable to fractures of the steering knuckle.

These are local weaknesses which have to be provided for in drawing up the lists of parts to be stocked, and are only given to show that uniform proportions throughout the automobile service will lead on the one hand to accumulations of dead stock, and on the other to vehicles tied up for lack of parts.

Another situation which has been found necessary to guard against very closely is the accumulation of stocks at various points in the service. The mechanics working on a column have need of one crown wheel. Unless controlled they will put in a requisition for six, using one and stocking the other five. A new cylinder being required, they will ask for a group complete with pet cocks, valves, springs, valve caps, fan bearing and brackets, etc., although all these parts may be available for use on the discarded cylinder. One American maker always ships his power plants complete in every respect, carbureter, magneto, fan, bolts for attaching to frame, etc. Whenever these are sent direct to repair units at the front the accessories are taken off and replaced by old ones withdrawn from the damaged engine, the new parts going to augment the stock, but without figuring on the stock list.

In order to avoid, as far as possible, all such accumulations of stock, the French service stipulates the parts and the quantities of such parts which can be kept, as follows:

1—On the truck.
2—In the hands of the column mechanics.
3—At the advanced workshop.
4—At the supply base.

Generally, before a new part is issued the old part must be returned, thus proving that the part is not being ordered needlessly with the object of getting together a little reserve stock. The same rule applies to tires: before a new shoe or casing is issued the old one must be presented. This has put a stop to the practice of leaving old tires by the roadside, and also prevents unscrupulous persons giving army tires away to friends.

Chromium Steels for Permanent Magnets

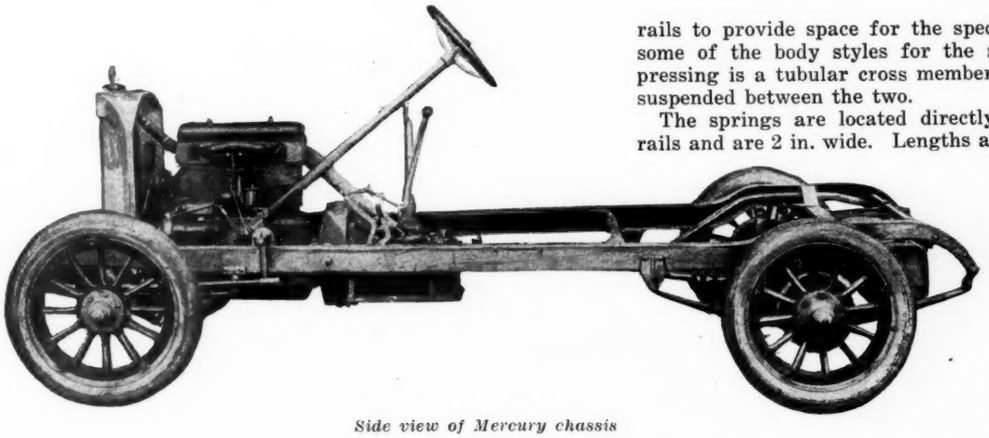
ALL high-grade permanent magnets used for industrial purposes have in the past been made of tungsten steel. This same steel is also used as tool steel, the well-known high-speed steel being a tungsten-alloy steel. In Germany, all tungsten was commandeered shortly after the outbreak of the war, by the government, and the electrical industries were then hard put to it in finding a substitute for their conventional magnet steel.

Experiments on the use of chromium in the place of tungsten, which had already been projected before the war, were accelerated. The research has been conducted in the Reichsanstalt on behalf of the Verband Deutscher Elektrotechniker. The preliminary report, published by the Reichsanstalt in 1917, did not give particulars, which were, however, to be communicated to members of the Verband on inquiry. Krupp's works supplied 37 specimens of steel containing varying percentages of chromium and of carbon; they had been turned into rods and hardened in various ways in the works, and were then aged, after the method of Strouhal and Barus, by repeated heating, cooling, and mechanical stress, while being tested at intervals in the Reichsanstalt.

The unfinished investigation concerns also the temperature coefficient of magnetization and the durability of the steels. It results that on an average chromium steels which have undergone suitable heat treatment do not rank below tungsten steels; the very best magnetic chromium steels, however, are not equal to tungsten steels. Technically, chromium steels would thus appear to be quite satisfactory, while for special researches their further improvement is desirable. These researches will probably be made in the near future.

Mercury a Semi-Custom Car with Stock Chassis

Employs Weidely Overhead Four Cylinder Engine—Has Transmission Brake—Bodies Are Built to Suit Purchaser



Side view of Mercury chassis

MERCURY CARS, INC., at Hollis, L. I., are producing a car designed to meet the demand for a small automobile of high quality in chassis and body. The result is a semi-custom-made job in which the bodies are intended to fit the particular needs of the purchaser and to conform to his taste in color and style, while the chassis is a stock product. The price of the car, of course, will vary with the body selected, but may be judged by the fact that the four-passenger job, which is practically a stock model, sells for $2,950. The chassis has a 114-in. wheelbase and is mounted on 31 by 4-in. tires. With the small wheels the relatively short chassis fits well into the custom body scheme.

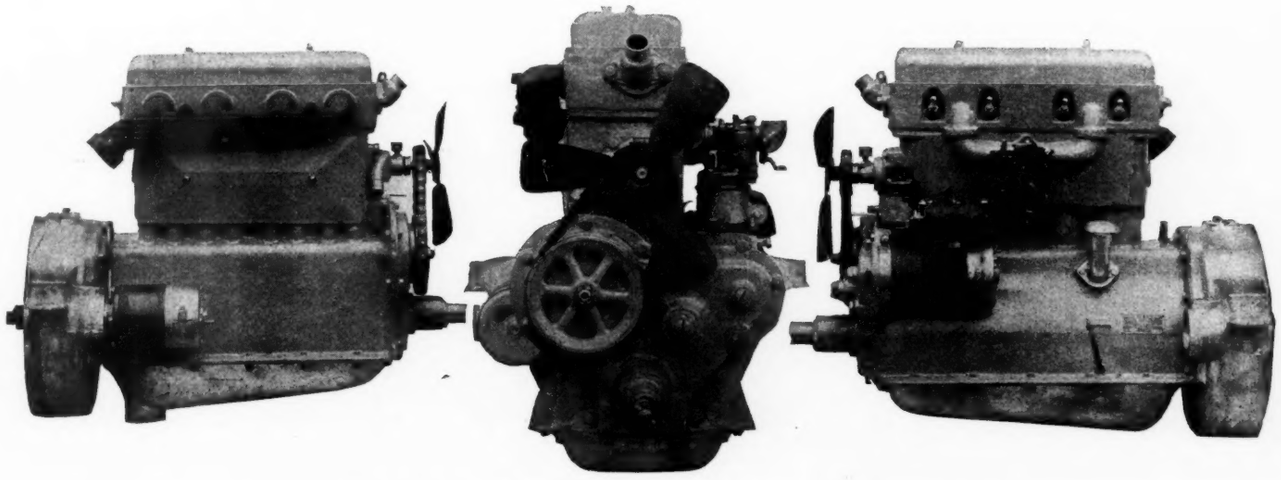
The frame is made of 4½-in. channel and tapers uniformly from front to rear. Being wide in the rear, it allows the weight of the body to be carried close to the wheels. It is provided with three pressed-steel cross members, the front member having a deep drop to support the forward end of the engine. The rear cross member is located below the side rails to provide space for the special mounting provided in some of the body styles for the spare tire. Back of this pressing is a tubular cross member and the gasoline tank is suspended between the two.

The springs are located directly beneath the frame side rails and are 2 in. wide. Lengths are 36 and 52 in. front and rear respectively. The rear springs are underslung. The springs are designed to be practically flat under load and are of chrome vanadium steel. Hotchkiss drive is employed and the spring eyes and bolts are provided with self-lubricating bushings, thus eliminating several grease cups, leaving 7 on the chassis.

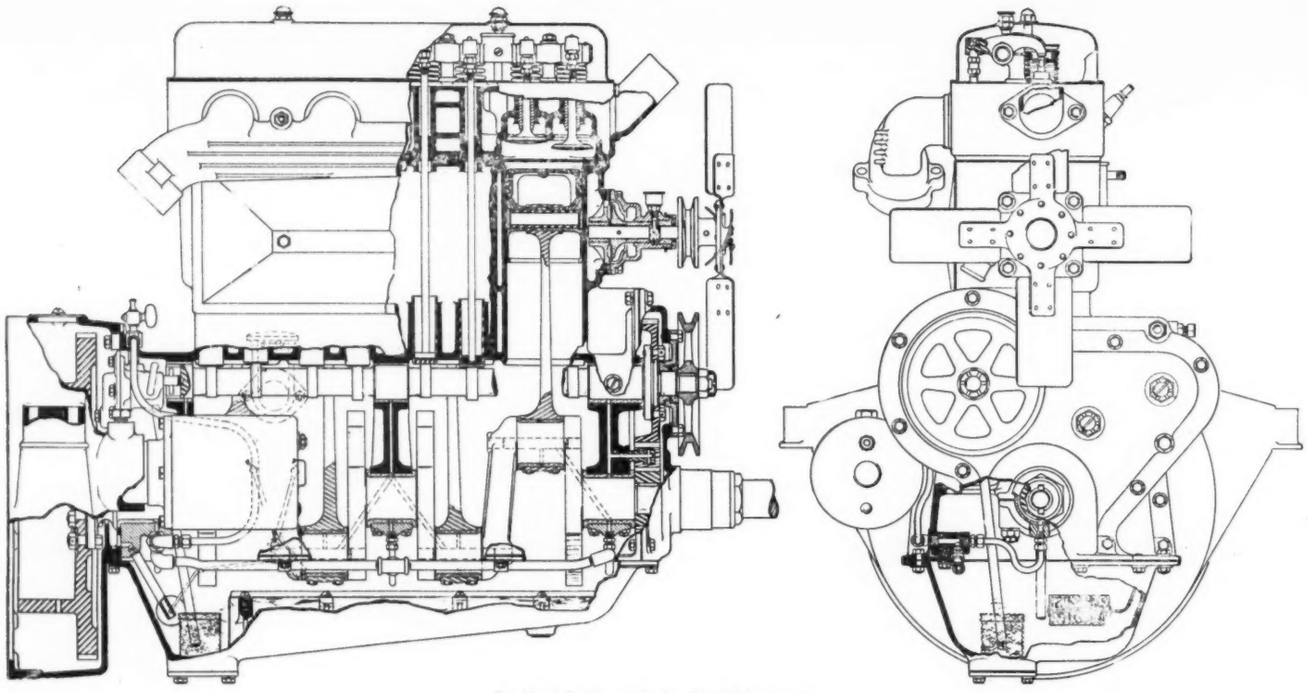
The Weidely overhead, 3½ by 5½ in. four-cylinder engine is used in conjunction with a unit powerplant mounted with three-point suspension. The front spigot bearing rests in a pillow block bolted on the front cross member by a long U bolt and is provided with a self-lubricated bushing of impregnated wood. The two rear supports are cast on the bell housing in the form of arms which are bolted to the frame side members.

Brief Specifications

Cylinder number	4
Cylinder dimensions	3¾ x 5½ in.
Piston displacement	243 cu. in.
Clear valve diameter	1⅞ in.
Valve lift	5/16 in.
Crankshaft diameter	2⅛ in.
Lubrication, pressure feed to all engine bearings.	



Three views of the Weidely four engine used on the Mercury car



Sectional view of the Weidely engine

Elliptic section connecting-rods are used and at the lower ends there are four bolts. The crankshaft has three bearings; it is of the counterbalanced type and is drilled for pressure oiling. The camshaft is driven through helical gears actuating the overhead rocker mechanism and the valves, which latter are 1⅞ in. diameter in the clear.

A feature of the engine is the unit casting employed for the cylinder block which also includes the intake manifold. With this arrangement the carbureter connections need not be disturbed when the cylinder head is removed. The exhaust-manifold is provided with integral cooling fins. The extension of the pump shaft carries the fan, which is driven by a V-belt. The radiator is a removable core type and has 5 gal. capacity; it is supported on a large sheet of cork within a shell of patented design. The shell is built up on a pressed-steel base so designed as to rigidly support the radiator construction and at the same time to provide the necessary flexibility to take care of weaving of the frame.

The electric system is a two-unit Delco with flange-supported motor and generator. The starting engagement is provided by a Bendix gear drive. Carburetion is by the new Stromberg Type M instrument and oiling is by a full pressure feed system through a hollow shaft. The drive is taken through an eleven-disk dry clutch faced with Raybestos, a three-speed gearset and a three-quarter floating spiral bevel rear axle with annular ball bearings throughout. There is only one set of brakes on the rear wheels, the service brake being a transmission unit of the external contracting type acting on an 8¼-in. drum mounted on the front universal joint. Adjustment of this is made easy by locating the thumb nut which controls it beneath a small trap door in the front floorboard through which the driver can control the application without leaving his seat. The rear brake connection consists of a single cable, and this simplification of the brake linkage has resulted in an exceptionally clean chassis.

Another feature of accessibility is the use of a second trap door providing access to the storage battery which is located beside the gearset on the opposite side from the exhaust pipe. The gasoline tank is of pressed steel, of 16 gal. capacity and is fitted with a 2 gal. reserve for emergency. Standard fittings on the car are a Boyce Moto-Meter, oil pressure gage, ammeter, 8-day clock, magnetic gasoline gage, Van Sicklen speedometer, combination lighting and ignition switch with Yale lock on hood and on dash compartment, all being operated by a master key.

The bodies are practically custom built, as stated, although of semi-stock design, the purchaser's ideas being carried out in regard to details. In the small four-passenger touring model which was exhibited at the Astor Salon, the space under the cowl is lighted and ventilated, three ventilators being provided for the latter purpose, two on the side and one above, this upper one, having a curved glass panel. The front seats are divided and adjustable to accommodate the driver. This body has two doors and has a locker at the rear which completely conceals the spare tire without producing the objectionable bulging back.

Industrial Trucks

In our Jan. 17 issue appeared a brief description of the Barrett multi-truck for moving material and products in industrial works. Below are shown several views of this truck.

Barrett multi-truck and its method of use

Chevrolet Company Adds Light Truck

Sold Either as a Chassis or with an Open or Covered Body—Has Worm Gear Drive

MORE and more of the companies manufacturing popular-priced passenger cars are turning their attention to the light truck field and bringing out models of commercial vehicles embodying the same power plant as their passenger cars. The latest concern to take this step is the Chevrolet Motor Co. of New York and Flint, Mich., which has just announced a 1-ton truck chassis to sell at $1,125. This same chassis equipped with an open delivery body sells at $1,245 and with an eight-post top and body at $1,320, all prices being f.o.b. Flint.

An interesting feature of the new car is that it has a full electric equipment, including both a starter and a lighting system. The frame is sufficiently long to carry a standard body with a clear loading space of 9 ft. 6½ in. and a clear inside width of 3 ft. 9¾ in. The large loading space of the body enables the vehicles to be used in almost every conceivable kind of business.

The truck is fitted with a valve-in-the-head type engine with a piston displacement of 224.3 cu. in. It is mounted under a conventional hood forward of the dash and is carried on arms extending to each side of the frame. The rear end is carried on two heavy malleable iron castings hot riveted to the frame and held in place by two drop-forged U-bolts. The front is hung in shackles bolted to the motor arms and to two substantial brackets hot riveted to the frame. The cylinders are cast in block and are provided with a removable cylinder head. Lynite pistons with three rings are employed and the crankshaft is carried on three main bearings.

The engine is water cooled by means of a centrifugal pump circulating the water through a cellular type radiator with a heavy brass core and a pressed steel casting. The radiator is mounted on two V-shaped slotted steel springs bolted to the front cross member and resting on two steel washers. A 15-in. pressed steel fan is employed and is driven by a V-shaped leather link belt.

A Zenith carbureter is used with a hot-air-jacketed intake manifold. The carbureter is fed by gravity from a 13-gal. tank located under the driver's seat. All the air enters the carbureter through a combined strangler and temperature regulator which provides a cold-air opening during warm weather. A Monarch suction governor is installed between the carbureter and the intake manifold to limit the speed of the truck to 25 miles an hour.

Ignition is by a Remy distributer. An Auto-Lite generator is employed and begins to produce a charging current at a vehicle speed of about 6 miles per hour. The electric starter is also an Auto-Lite product. It is mounted on the rear motor arm and operated through a Bendix drive.

From the engine the drive is taken through a cone clutch with a leather facing and thence to a three-speed selective gearset. The gearset is carried on a frame bolted to the flywheel housing, and can be quickly and easily removed, being located directly under the driver's floorboards.

From the gearset the drive is taken through a seamless steel tube propeller shaft with three universal joints to the worm-driven rear axle, of which the worm and worm gear are made by the Cleveland Worm & Gear Co. The rear axle housings are of malleable iron and the axle shafts are of the semi-floating type.

Hotchkiss drive is employed, both the torque and propulsion being taken through the springs. Two separate sets of brakes of the internal-expanding type are located on the rear wheels. Each brakeshoe is 14 in. in diameter and 2 in. wide. Both sets of brake rods are provided with turnbuckles conveniently located to take up all brake wear. The frame is of open-hearth rolled steel channel 4 in. deep, and is provided with three cross members.

The wheels are of the artillery type and have 12 hickory spokes, front and rear. The front wheels are fitted with Timken roller bearings and are provided with malleable iron hubs with flanges of pressed steel. For greater speed, pneumatic tires are employed in front and solids in the rear. Left steer and center control are employed.

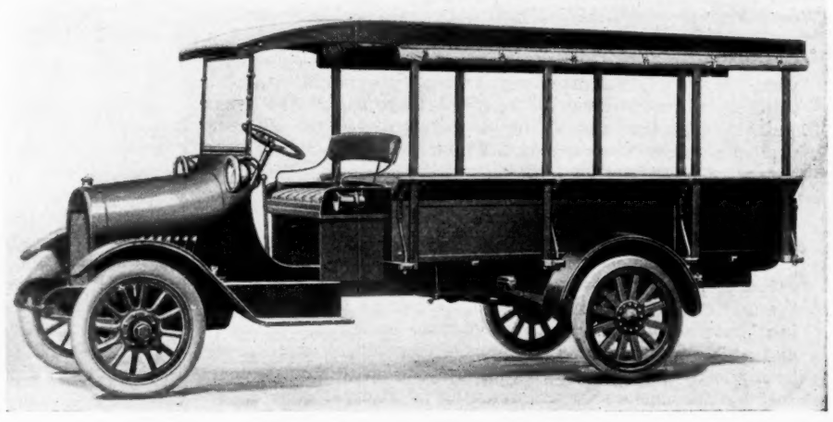
The engine hood is of heavy sheet steel with three hinge rods. An anti-squeak is used on both ends of the hood to prevent rattling, and the sides each have seven louvres for better air circulation. The cowl is also of heavy sheet steel riveted in place and carrying the instrument board, on which are mounted the speedometer, carbureter choke, ammeter, oil pressure gage and the lighting and ignition switch. Passenger type front and rear fenders are used. They are of pressed steel in one piece and are crowned and attached to the frame side members by a heavy pressed steel V-section iron with a heavy sheet steel apron extending to the frame and completely inclosing the sides and protecting the runningboards from mud and water.

BRIEF SPECIFICATIONS

Load capacity	1 *ton*
Wheel base	125 *in.*
Cylinder number	4
Cylinder dimensions	3 11/16 *x* 5¼ *in.*
Piston displacement	224 *cu. in.*
Final drive	*Worm*
Torque and thrust on springs.	
Price of chassis	$1.125

Cost of Plowing in England

In the House of Commons recently, in reply to a question by Colonel Faber, Mr. Prothero stated that the average gross expenditure throughout England and Wales on motor plowing from spring to August last was 28s. 6d. ($6.92) per acre. This cost included work on the farm, traveling from place to place, labor, repairs and maintenance.



Chevrolet truck with covered body

More S. A. E. Aircraft Practices

Specifications for Flexible Steel Wire Cable, Tachometer Drive from the Engine, Rubber Hose for Gasoline and Reels for Cable

The following table forms part of the specifications of flexible 6 x 7 steel wire cable printed in last week's issue of AUTOMOTIVE INDUSTRIES:

TABLE OF WEIGHTS, SIZES AND STRENGTH OF CABLE

Diameter, Inches	Minimum Breaking Strength, Pounds	Approximate Weight, Pounds per 100 Ft.
0.312 (5/16)	7,900	15.00
.250 (¼)	5,000	9.50
.218 (7/32)	4,000	7.43
.187 (3/16)	2,750	5.30
.156 (5/32)	2,200	4.20
.125 (⅛)	1,150	2.20
.109 (7/64)	830	1.50
.094 (3/32)	780	1.30
.078 (5/64)	480	.83
.062 (1/16)	400	.73

Flexible 7 x 7 Steel Wire Cable

S. A. E. Recommended Aeronautic Practice

This specification covers high strength 7 x 7 flexible steel wire cable used in the construction of aircraft where flexibility is important.

Manufacture—The steel wires composing the individual strands of the cable shall be laid concentrically around the center wire in one layer of six wires with a left-hand (counter-clockwise) pitch or lay. The cable itself shall be constructed by twisting six of these strands composed of seven wires each around a seventh strand of the same construction and material with a right-hand (clockwise) pitch and with a length of lay of six to eight times the diameter of the whole.

Wires composing the cable shall be uniformly coated with pure tin to solder readily.

Joints in wires in cable having a diameter of 0.156 (5/32) in. and larger shall be brazed in a gas fire. In cable having a diameter of 0.125 (⅛) in. or less, wires may be joined either by brazing or twisting, at the manufacturer's convenience. Tucked-in or welded joints are not permitted. No two joints in individual wires shall be closer to one another in the completed cable than 30 ft. All brazed joints shall be tinned. Exposed brass at joints shall not constitute cause for rejection.

Workmanship and Finish—Each length of cable is to be evenly laid, and free from kinks, loose wires, or other irregularities. The cable shall remain in this condition when unwound from the reel or bent around a standard thimble, proper precautions being taken to secure the ends.

Physical Properties and Tests—Tensile test—A tensile test shall be made upon each individual reel of cable purchased of a size.

Samples of cable for testing for tensile strength shall be no less than 24 in. in length. In making tests the distance between jaws of testing machine with sample in place and before test shall be not less than 10 in.

Samples for tensile test may be clamped in the jaws of the testing machine in the usual manner to facilitate testing; but in case of failure or dispute on individual tests and at the request of the manufacturer, check tests shall be made by socketing the samples with pure zinc.

Cable for use in the construction of aircraft shall meet the required breaking strength specified in the table.

Bend Test—One bend test is to be made on a sample cut from each reel of cable of a given size. Each sample must be bent once around its own diameter and straightened again at least 20 times in succession in the same direction of bending without any of the wires breaking.

Torsion Test—A torsion test is to be made on one wire from each sample of cable for tensile test. The wire is to be gripped by two vises 8 in. apart. One vise shall be turned uniformly at as high a rate of speed as possible without perceptibly heating the wire. One vise shall have free axial movement in either direction.

The number of complete turns which the wire shall stand is determined by the formula:

$$\text{Number of turns} = \frac{2.2}{\text{diameter in inches}}$$

Failure of one piece of wire to show full number of turns specified in the above torsion test shall not be considered cause for rejection, but in such case two additional tests shall be made on two more wires from the same sample of cable, and if both samples meet the requirements of the specifications the cable shall be accepted in this respect.

Dimensions and Tolerances—There shall be no permissible variation in gage below size. Cable having a diameter of 1/16 to 3/32 in. inclusive, shall have a permissible variation of 12 per cent above size; cable having a diameter of ⅛ to 3/16 in. inclusive, shall have a permissible variation of 10 per cent above size, and cable having a diameter of 7/32 to ⅜ in. inclusive, shall have a permissible variation of 7 per cent above size.

TABLE OF WEIGHTS, SIZES AND STRENGTH OF CABLE

Diameter, Inches	Minimum Breaking Strength, Pounds	Approximate Weight, Pounds per 100 Ft.
0.312 (5/16)	9,200	16.70
.250 (¼)	5,800	10.50
.218 (7/32)	4,600	8.30
.187 (3/16)	3,200	5.80
.156 (5/32)	2,600	4.67
.125 (⅛)	1,350	2.45
.094 (3/32)	920	1.45
.078 (5/64)	550	.93
.062 (1/16)	480	.81

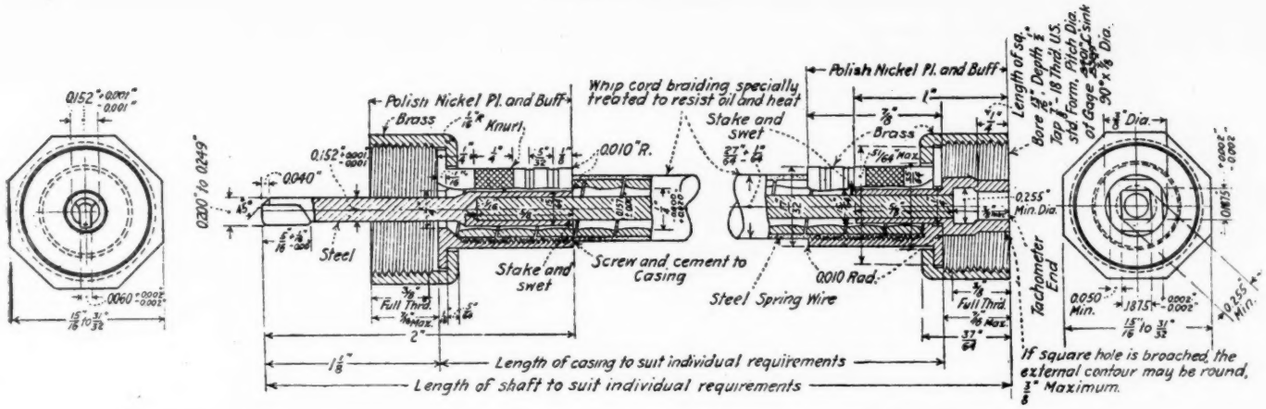
Extra Flexible 7 x 19 Steel Wire Cable

S. A. E. Recommended Aeronautic Practice

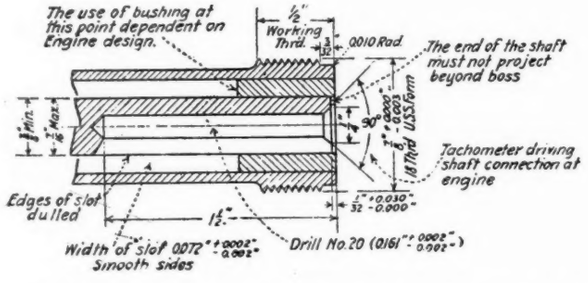
This specification covers high strength 7 x 19 extra flexible steel wire used in the construction of aircraft where extra flexibility is important.

Manufacture—The steel wires composing the individual strands of cable shall be laid concentrically around the center wire in one layer of 6 wires and another, or outer layer, of 12 wires with a left-hand (counter-clockwise) pitch, the lay or pitch of both layers being of the same length; the cable itself shall be constructed by twisting 6 of these strands composed of 19 wires each around a seventh strand of the same construction and material with a right-hand (clockwise) pitch or lay of 6 to 8 times the diameter of the whole.

It is to be understood that the strand composing this cable must not necessarily be composed of wires all of the same diameter.


Polish Nickel Pl. and Buff
Brass
Knurl
Whip cord braiding specially treated to resist oil and heat
Stake and swet
Steel
Screw and cement to Casing
Steel Spring Wire
Length of casing to suit individual requirements
Length of shaft to suit individual requirements
If square hole is broached, the external contour may be round,
Tachometer End

Tachometer Drive


The use of bushing at this point dependent on Engine design.
Working Thrd.
The end of the shaft must not project beyond boss
Tachometer driving shaft connection at engine
Edges of slot dulled
Width of slot
Smooth sides
Drill No. 20

Wires composing the cable shall be uniformly coated with pure tin to solder readily.

Joints in wires in cable having a diameter of 0.187 (3/16) in. and larger shall be brazed in a gas fire. In cable having a diameter of 0.156 (5/32) in. or less, wires may be joined either by brazing or twisting at the manufacturer's convenience. Tucked in or welded joints are not permitted. No two joints in individual wires shall be closer to one another in the completed cable than 30 ft.

Workmanship and Finish—Each length of cable is to be evenly laid, and free from kinks, loose wires, or other irregularities. The cable shall remain in this condition when unwound from the reel or bent around a standard thimble, proper precautions being taken to secure the ends.

Physical Properties and Tests—Tensile test—A tensile test shall be made upon each individual reel of cable purchased of a size.

Samples of cable for testing for tensile strength shall be no less than 24 in. in length. In making tensile tests the distance between jaws of testing machine with sample in place and before test shall be not less than 10 in.

Samples for tensile test may be clamped in the jaws of the testing machine in the usual manner to facilitate testing, but in case of failure or dispute on individual tests, and at the request of the manufacturer, check tests shall be made by socketing the samples with pure zinc.

Cable for use in the construction of aircraft shall meet the required breaking strength specified in the table.

Bend Test—One bend test is to be made on a sample cut from each reel of cable of a given size. Each sample must be bent once around its own diameter and straightened again at least 20 times in succession in the same direction of bending without any of the wires breaking.

Torsion Test—A torsion test is to be made on one wire from each sample of cable taken for tensile test. The wire is to be gripped by two vises 8 in. apart; one vise shall be turned uniformly at as high a rate of speed as possible without perceptibly heating the wire. One vise shall have free axial movement in either direction.

The number of complete turns which the wire shall stand is determined by the formula:

$$\text{Number of turns} = \frac{2.2}{\text{diameter in inches}}$$

Failure of one piece of wire to show full number of turns specified in the above torsion test shall not be considered cause for rejection, but in such case two additional tests shall be made on two more wires from the same sample of cable, and if both samples meet the requirements of the specification the cable shall be accepted in this respect.

Dimensions and Tolerances—There shall be no permissible variation in diameter below size. Cable having a diameter of 0.125 (⅛) to 0.187 (3/16) in., inclusive, shall have a permissible variation of 10 per cent above size, and cable having a diameter of 0.218 (7/32) to 0.375 (⅜) in., inclusive, shall have a permissible variation of 7 per cent above size.

Tachometer Drive

S. A. E. Recommended Aeronautic Practice

Instrument End—The upper or instrument end of the shaft has a squared socket, made integral with a shoulder which forms a thrust bearing.

Engine End—The lower or engine end is finished with a cylindrical end with a single integral key.

Casing—The casing is to be of flexible metallic tubing, covered with whipcord braid and impregnated to prevent oil leakage; similar to sample, or covered with other material which will be equally flexible, oil tight and free from stretching and of no greater weight than the whipcord braid covering casing. The outside diameter of casing to be over braid to be approximately 7/16 in.; the inside diameter of casing to be approximately ¼ in. The ends of the casing are finished alike, as shown in detailed sketches. The screw-threaded sockets covering the whipcord braid are screwed in place and set with shellac or other suitable material to form an oil-tight and permanent connection.

Shaft End—The shaft end at the engine is drilled and slotted to fit the tachometer shaft end, allowing for end-play of at least 1 in. More play than this may be required where the drive shaft is more than 6 ft. in length, the amount to be determined experimentally.

Drive Shaft—Drive shaft to be of helical wire wound construction, with core wires.

Spindle—The tachometer spindle is finished square to fit the square socket on the drive shaft.

Drive Shaft—Drive shaft will rotate at one-half crank shaft speed.

End Nuts—Size and contour of exterior circumference of end nuts optional, but 15/16 octagon recommended.

Rubber Hose for Gasoline

S. A. E. Recommended Aeronautic Practice

COTTON PLY—TYPE No. 1

PART 1. TECHNICAL

A.—Description

Construction—The gasoline hose must consist of rubber and cotton constructed in the following manner, and the quality of the finished hose must be uniformly good throughout.

Inner Tube—The inner tube is to be made of rubber free from flaws or cracks and of a quality conforming to the conditions laid down in this specification.

When of an internal diameter of ¾ in. or less, this inner tube must be seamless. Tubes of larger internal diameter may be made from rubber sheet, in which case they must consist of at least two complete turns and be formed into a complete tube in the further process of manufacture.

Cotton Plies—The cotton shall consist of either braided or canvas plies and shall comply with the following table:

Internal Dia. of Hose	Up to and Including ⅝ In.	11/16 In. to 1½ In.	Greater than 1½ In.
Number of plies	Not less than two	Not less than three	Not less than four

Outer Cover—The outer cover is to be made of rubber of the same quality as that used for the inner tube, and of good workmanship and finish.

Dimension Limit—The internal diameter of the hose must not vary more than plus or minus 3 per cent of the internal diameter stated on the order.

Length of Hose—The contractor, when quoting or when acknowledging an order for this class of hose, must state the lengths in which it can be supplied. The hose should be supplied in the maximum lengths possible.

B.—Physical Properties

Flexibility—By "Flexibility" is meant ability to bend without kinking.

When hose of internal diameter (y) is bent around a cylinder having a diameter equal to x times the external diameter of the hose, as shown in the following table, the external diameter of the hose must not increase or diminish by more than 10 per cent.

Internal Diameter of Hose (y)	x
Less than ½ in.	8
½ in. to ¾ in.	12
13/16 in. to 1⅛ in.	14
Above 1⅛ in.	16

The hose, after having been filled with gasoline for two hours, must withstand a minimum internal hydraulic pressure of P pounds per square inch, depending upon the internal diameter (D) of the hose without showing defects.

D—Internal Dia. in Inches	Min. Pressure in Lbs. per Sq. In. (P)
Up to ½ inclusive	160
9/16 to 1 inclusive	140
1 1/16 to 1½ inclusive	120
1 9/16 to 2 inclusive	100
Above 2	80

C.—Chemical Properties

Rubber—The percentage of rubber shall not be less than 25. The amount of free sulphur in either the tube or the cover must not exceed 1 per cent.

Dry Heat Test—A 3-in. piece of the hose after having been placed in an air oven at 132 deg. C. for 2 hours, must show, when cool, no tendency to crack, and must not be tacky.

Permeability to Gasoline—The specific gravity of the gasoline used in this test should be between 0.710 and 0.725 at 60 deg. F.; 65 per cent of it must distill at over 100 deg. C. from a distillation flask when the bulb of the thermometer is just below the side tube. A 14-in. length of the hose is held vertically and plugged at the bottom. The upper end is fitted with a glass tube about 18 in. long. The hose so arranged is filled with gasoline to a head of 12 in. above the top of the acting length of the hose. The acting length of the rubber hose is 12 in. The upper end of the glass tube is loosely closed with a cork.

During the first 24 hours the level of the gasoline will fall comparatively rapidly. The loss of gasoline is made good by frequent additions from a known volume of gasoline, care being taken that the level of the gasoline in the glass tube does not fall at any time by more than 3 in. The test is to last for 72 hours, and the loss of gasoline during the third 24 hours must not exceed 100 cc. per square foot of the original internal surface of the hose.

Immersion in Gasoline—A 3-in. piece of the hose is boiled for one hour (using a reflex condenser) in gasoline similar to that used for the permeability test. The gasoline is allowed to cool down. Twenty-four hours later the test piece is removed from the gasoline and examined without delay, as follows:

The internal diameter at the point of greatest constriction is measured by means of rod gages. From this measurement the area of the bore is calculated. It must not differ from the original by more than 25 per cent.

The test piece is then cut longitudinally into halves, and the adhesion between rubber and cotton carefully examined. The adhesion must be of such a character that the rubber can only be stripped from the cotton by hand with difficulty.

Immersion in Oil—A 3-in. piece of the hose is immersed in an oil approved by purchasing office at a temperature of 100 deg. C. for 8 hours, and for a further period of 24 hours at ordinary temperature. The oil is then wiped from the surface of the hose. The decrease of internal diameter shall be less than 10 per cent.

The flexibility and elasticity of the rubber must not be diminished and there must be no tendency of the rubber to separate from the cotton.

PART II. INSPECTION

Test Pieces—The purchaser will decide where the tests are to be carried out. All test specimens are to be cut in the presence of the inspector and they are to be marked as he may direct.

For the purpose of testing, a representative sample will be cut from each 1000 ft. of hose or fraction thereof, and the tests will proceed in accordance with the purchasing office's instructions.

Rejections—If any sample fails to comply with any of the above tests, the hose represented thereby will be rejected.

Marking—Accepted and rejected material must be marked as directed by the inspector.

PART III. SPECIAL CONDITIONS

Depreciation—The contractor must bear the cost of the depreciation in value of any rejected material due to test pieces being cut therefrom.

Rejected Material—The contractor must not supply any material which has previously been rejected by any Government department, without giving full written particulars of the previous rejection to the inspector who is inspecting to this specification.

Rubber Hose for Gasoline

S. A. E. Recommended Aeronautic Practice

COTTON PLY REINFORCED WITH WIRE

TYPE No. 2

PART I. TECHNICAL

A. Description

Construction—The gasoline hose must consist of rubber and cotton constructed in the following manner, and the quality of the finished hose must be uniformly good throughout.

Inner Tube—The inner tube shall consist of a canvas tube supported by a helix of oil tempered steel wire of not less than .020-in. diameter, spaced not less than five turns per inch. The rubber tube shall be placed between this inner cotton tube and the cotton plies specified below.

Cotton Plies—The cotton shall consist of either braided or canvas plies and shall comply with the following table. The inner cotton tube shall not be considered one of the plies specified.

Internal Dia. of Hose	Up to and Including ⅝ In.	11/16 In. to 1½ In.	Greater than 1½ In.
Number of plies	Not less than two	Not less than three	Not less than four

Outer Cover—The outer cover is to be made of rubber of the same quality as that used for the inner tube, and of good workmanship and finish.

Dimension Limit—The internal diameter of the hose must not vary more than plus or minus 3 per cent of the internal diameter stated on the order.

Length of Hose—The contractor, when quoting or when acknowledging an order for this class of hose, must state the lengths in which it can be supplied. The hose should be supplied in the maximum lengths possible.

B. Physical Properties

Flexibility—By "Flexibility" is meant ability to bend without kinking.

When hose of internal diameter (y) is bent around a cylinder having a diameter equal to x times the external diameter of the hose, as shown in the following table, the external diameter of the hose must not increase or diminish by more than 10 per cent.

Internal Diameter of Hose (y)	x
Less than ½ in.	8
½ in. to ¾ in.	12
13/16 in. to 1⅛ in.	14
Above 1⅛ in.	16

The hose, after having been filled with gasoline for two hours, must withstand a minimum internal hydraulic pressure of P pounds per square inch, depending upon the internal diameter (D) of the hose, without showing defects.

D—Internal Dia. in Inches	Min. Pressure in Lbs. per Sq. In. (P)
Up to ½ inclusive	160
9/16 to 1 inclusive	140
1 1/16 to 1½ inclusive	120
1 9/16 to 2 inclusive	100
Above 2	80

C. Chemical Properties

Rubber—No organic matter other than Para or plantation rubber shall be used in the preparation of this hose. The percentage of rubber shall not be less than 25.

The amount of free sulphur in either the tube or the cover shall not exceed 1 per cent.

Dry Heat Test—A 3-in. piece of the hose after having been placed in an air oven at 132 deg. C. for 2 hours must show, when cool, no tendency to crack, and must not be tacky.

Permeability to Gasoline—The specific gravity of the gasoline used in this test should be between 0.710 and 0.725 at 60 deg. F.; 65 per cent of it must distill over at 100 deg. C. from a distillation flask when the bulb of the thermometer is just below the side tube. A 14-in. length of hose is held vertically and plugged at the bottom The upper end is fitted with a glass tube about 18 in. long. The hose so arranged is filled with gasoline to a head of 12 in. above the top of the acting length of the hose. The acting length of the rubber hose is 12 in. The upper end of the glass tube is loosely closed with a cork.

During the first 24 hours the level of the gasoline will fall comparatively rapidly. The loss of gasoline is made good by frequent additions from a known volume of gasoline, care being taken that the level of the gasoline in the glass tube does not fall at any time by more than 3 in. The test is to last for 72 hours, and the loss of gasoline during the third 24 hours must not exceed 100 cc. per square foot of the original internal surface of the hose.

Immersion in Gasoline—A 3-in. piece of the hose is boiled for one hour (using a reflex condenser) in gasoline similar to that used for the permeability test. The gasoline is allowed to cool down. Twenty-four hours later the test piece is removed from the gasoline and examined without delay, as follows:

The internal diameter at the point of greatest constriction is measured by means of rod gages. From this measurement the area of the bore is calculated. It must not differ from the original by more than 25 per cent.

The test piece is then cut longitudinally into halves, and the adhesion between rubber and cotton carefully examined. The adhesion must be of such a character that the rubber can only be stripped from the cotton by hand with difficulty.

Immersion in Oil—A 3-in. piece of the hose is immersed in an oil approved by purchasing office at a temperature of 100 deg. C. for 8 hours, and for a further period of 24 hours at ordinary temperature. The oil is then wiped from the surface of the hose. The decrease of internal diameter shall be less than 10 per cent.

The flexibility and elasticity of the rubber must not be diminished and there must be no tendency of the rubber to separate from the cotton.

PART II. INSPECTION

Test Pieces—The purchaser will decide where the tests are to be carried out. All test specimens are to be cut in the presence of the inspector and they are to be marked as he may direct.

For the purpose of testing, a representative sample will be cut from each 1000 ft. of hose or fraction thereof, and the tests will proceed in accordance with the purchasing office's instructions.

Rejections—If any sample fails to comply with any of the above tests, the hose represented thereby will be rejected.

Marking—Accepted and rejected material must be marked as directed by the inspector.

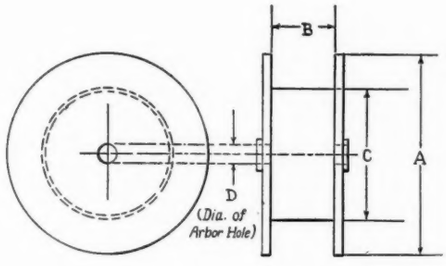
PART III. SPECIAL CONDITIONS

Depreciation—The contractor must bear the cost of the depreciation in value of any rejected material due to test pieces being cut therefrom.

Rejected Material—The contractor must not supply any material which has previously been rejected by any Government department, without giving full written particulars of the previous rejection to the inspector who is inspecting to this specification.

Reels for Cable

S. A. E. Recommended Aeronautic Practice



Diameter of Cable	1,000 Feet				3,000 Feet				5,000 Feet				10,000 Feet			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
1/32	12	4	8	1⅛	12	4	8	1⅛	12	4	8	1⅛	16	4	10	1⅛
1/16	12	4	8	1⅛	12	4	8	1⅛	16	4	10	1⅛	16	7	12	1⅛
5/64	12	4	8	1⅛	16	4	10	1⅛	16	7	12	1⅛	16	10	8	1⅛
3/32	12	4	8	1⅛	16	4	10	1⅛	16	7	12	1⅛	16	10	8	1⅛
7/64	16	4	10	1⅛	16	7	12	1⅛	16	10	8	1⅛	18	10	8	1⅛
1/8	16	4	10	1⅛	16	7	12	1⅛	16	10	8	1⅛	24	10	10	1⅛
9/64	16	7	12	1⅛	16	10	8	1⅛	24	10	10	1⅛	24	16	10	2⅛
5/32	16	7	12	1⅛	16	10	8	1⅛	24	10	10	1⅛	24	16	10	2⅛
3/16	18	7	12	2⅛	18	10	8	2⅛	24	10	10	2⅛	24	16	10	2⅛
7/32	18	7	12	2⅛	18	10	8	2⅛	24	10	10	2⅛	32	20	16	3⅛
1/4	18	10	10	2⅛	24	10	10	2⅛	32	18	16	2⅛	36	22	18	3⅛
5/16	18	10	10	2⅛	24	10	10	2⅛	32	18	16	2⅛	36	22	18	3⅛
11/32	18	10	8	2⅛	32	16	16	2⅛	32	20	16	3⅛	50	16	26	3⅛
3/8	18	10	8	2⅛	32	16	16	2⅛	32	20	16	3⅛	50	16	26	3⅛

Dimensions given in inches.

Round solid high strength steel wire is to be shipped in coils or bundles protected with waterproof wrapping of paper.

In making racks for the above reels allow 4 in. greater width than the traverse specified above.

AUTOMOTIVE INDUSTRIES
The Automobile

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Gasoline and the Coal Shortage

MOST of the country's present difficulties are traceable to insufficient transport facilities. The coal shortage is due to the lack of a sufficient number of cars and of locomotives to haul them, and the scarcity of coal is at the bottom of many other troubles.

Owing to the limitations of our transport facilities it is plain that no obstacles should be placed in the way of producers of means of transport, including both passenger and commercial cars. In speaking of means of transport in a national sense we generally have in mind only the railroads, but the automobile and motor truck are coming to be a very large factor in interurban transportation. According to the N. A. C. C. the passenger-miles of automobile travel last year was equal to the passenger-miles of railroad travel, which permits of the conclusion that the automobile relieved the railroad of a great amount of passenger traffic.

Similarly the motor truck. Previous to the war its field outside of urban haulage was limited to transportation between neighboring cities but under the stress of war conditions and as a result of the unprecedented congestion in freight traffic practically all distance limits have been removed, as indicated by the fact that trucks are used regularly for transporting tires from Akron to Boston. It is not claimed that the motor truck can compete with the railroad in this work on an economic basis. The question in this instance is not how to get the goods to their destination at the least expense, but how to get them there, and the motor truck furnishes the answer.

With the great demand for transport facilities motor trucks will undoubtedly be more and more impressed into long-distance service, and passenger cars will be limited to strictly utilitarian and necessary uses. Suggestions have repeatedly been made that automobile traffic should be limited legally in this country, the same as it has been in England and France, but such proposals entirely disregard the difference in conditions here and abroad. England and France cannot keep their automobiles going because they have no native fuel; all of their motor fuel must come from the United States or other countries still farther away, and as the shipping tonnage is taxed to the utmost by the more direct essentials, food and munitions, fuel cannot be brought across in sufficient quantity.

In this country there is no present motor fuel famine. All our oil wells are running and the refineries producing gasoline at a rate never attained before. Owing to the lack of storage facilities the gasoline must be used practically as produced. The widespread use of gasoline as motor fuel helps to greatly reduce the demand for coal and thus to relieve the coal shortage. Our civilization requires the use of great amounts of power. Millions upon millions of horsepower are produced in gasoline engines, and if we could not use these engines we should have to require a great deal more coal-consuming steam plant. Therefore, there must be no restriction on the production of motor fuel and on the rational use of same.

The Motor Boat Show

ANOTHER one of the automotive industries is this week holding its annual national show—the motor boat industry—in Grand Central Palace. Some pride is taken in the fact that in spite of the war a very creditable exhibition has been staged. True, the show is not as representative of the industry as were its immediate predecessors, but there are very good reasons for the absence of some well-known firms, which are so loaded up with Government orders that they had absolutely no inducements to bid for private business. Then, the list of small engine makers seems to be getting shorter year by year, probably because competition by the real manufacturers is proving too much for them.

Large engines of the six and eight cylinder types are becoming more numerous each year. The marine 8-cylinder engine is different from the "automobile eight" in that it is of the vertical type with all cylinders in line. There is not sufficient room in a boat for a 90 deg. Vee engine, while there is plenty of room in a lengthwise direction. All of these large engines are now provided with electric

starters and with an electric lighting system, the starters and generators being of exactly the same type as carried on automobiles, but in most instances of larger dimensions. The air starter of former years seems to have been entirely abandoned. The newness of this electrical equipment in marine practice is painfully evident in the makeshift mountings found on many engines. Undoubtedly a few years hence the electric starter and generator will be fully provided for in the crankcase design and not bear evidence of their installation having been an afterthought.

In engine design there is a tendency toward smoother exteriors and the complete enclosure of all moving parts. Enclosed flywheels are not new in marine practice, but this year they are more numerous than ever before. The lowering in the grade of fuel has confronted marine motor designers with the same problem as automobile designers and combination manifolds are beginning to make their appearance. In this respect marine engine practice seems to lag far behind automobile practice, which may possibly be explained by the fact that the average motor boat is used only in warm weather and its engine never needs to be started in a zero atmosphere.

Magnetos Retain Their Hold

In spite of the widespread adoption of electrical equipment marine engine builders faithfully adhere to the magneto for ignition. When battery systems are used they are merely auxiliaries for starting and for emergencies. Many large engines are provided with two point ignition and one even has four-point ignition, there being two two-spark magnetos and each cylinder carrying four spark plugs.

The unit power plant idea has secured a very firm hold in the marine engine industry. That is to say, the engine and reverse gear are now built into a single unit so that all chance of disalignment of bearings is eliminated. With the usual practice of having the flywheel in front this can be done without wasting material in a bell-housing, though, as stated above, flywheel housings are also coming into use.

Marine engine designers are also working toward more silent operation of their engines. To this end they are adopting helical gears for camshaft and accessories drives, enclosing the valve mechanism, reducing tappet clearances, lightening valve reciprocating parts, enlarging camshafts and giving them a better support by using larger or more advantageously located bearings. Owners of racing boats do not mind the noise, but on cruisers silent operation is as much appreciated as on a touring car.

It is a gratifying experience at each succeeding motor boat show to note how the obsolete, poorly designed and crudely built engines are gradually disappearing, and engines of better design and more workman-like finish are taking their place. The marine engine industry is in a state of evolution; real engineering is taking the place of rule-of-thumb methods and real manufacturing methods are superseding jobbing shop standards.

The Garabed

A MYSTERIOUS invention or discovery has been occupying the attention of Congress for some time now. Pursuant to a joint resolution adopted by both houses of Congress a demonstration is to be made by the inventor before a committee of five scientists, and in case the latter are convinced of the merits of the invention, the Secretary of the Interior will secure an assignment from the inventor for its exclusive use by the Government.

In the resolution the new device is referred to as a free energy generator. This term is entirely new. The law of the conservation of energy teaches us that energy, like matter, is indestructible—that it can neither be generated nor destroyed—and "energy generator" therefore is a rather radical term. Of course, we have power generators, but this is an entirely different thing, as power is merely a manifestation of energy.

"Free energy" is somewhat confusing; we suppose it is intended to mean energy without cost. As a matter of fact, all sources of energy at present in use are free in one sense or another. The wind that turns windmills and propels sailing vessels is absolutely free; the water of our great falls, from which so much power is derived, finds its way to the falls without human guidance and therefore occasions no expense. Coal and oil are stored away in the Earth's crust and need only to be brought to the surface.

It is in adapting these sources of energy to our particular needs that expense arises, and it then often turns out that what at first sight seems to be the least expensive of all powers is the most expensive when everything is considered. Take, for instance, the case of wind power, which on casual consideration seems absolutely free. Yet ships propelled by wind power have found it impossible to compete with steamers consuming coal that at the wharf usually has to be well paid for. Evidently, therefore, though the wind itself is absolutely free, wind power has not proved the most economical in this case, simply because with it not the same results are obtainable as with steam.

Just what claims the inventor makes for the Garabed we do not know—they are not disclosed in the house resolution—but unless the new source of energy at least equals coal and petroleum in its economical possibilities it will hardly play an important role in the engineering world.

Usually Congress is rather lethargic in giving recognition to scientists and inventors. Now that it has decided to give a special hearing to an inventor, who apparently claims to be able to supply power more cheaply than is possible by any known method, it is no wonder that the curiosity of the business world is roused to a high pitch, though those who have had extensive experience with inventors are still inclined to be skeptical. No one at all familiar with mechanical science looks for a solution of the so-called perpetual motion problem, a phantom that has been chased by inventors for centuries, and for which "free energy" seems to be only another less discredited name.

Latest News of the

NoInterferenceWith Chicago Show

Neither Weather, Freight nor Fuel Will Seriously Affect Coliseum Exhibit

CHICAGO, Jan. 23—By telegram—The unprecedented weather conditions and the closing regulations of the Fuel Administrator are not going to interfere seriously with the annual Coliseum automobile show. It is probable that the show will be closed on Monday in accordance with the fuel regulations, although nothing has been definitely decided even at this date. It is probable that the building will be closed completely on Monday as well as on Sunday. There is a possibility, however, that the doors may be opened on Monday to dealers only, although the building will not be heated and possibly will not be lighted. Manager Miles intends to live up to the spirit and letter of the order and probably will not even burn the lights on Monday whether the doors are open or not. Inasmuch as the windows are completely obscured by decorations he feels little advantage is to be gained by opening the doors even to the dealer. The show therefore will be open to the public Saturday and from Tuesday to the following Saturday.

The tie-up of transportation is not seriously affecting exhibits, as a larger percentage of exhibits is now on hand than at this period of week before the opening in previous years. Manufacturers instead of sending all their cars from the New York exhibit to a greater extent have dispatched them from home factories, thus saving time and railroad charge.

Despite the traffic congestion, the fuel conservation order, and other abnormal situations, prospects for a good show from a business standpoint are bright. As usual the Chicago show will be the business show of the year and it is almost certain that it will exceed the recent exhibition in New York from the standpoint of business done and possibly also from the standpoint of attendance.

Decorations have a distinctly patriotic note, the feature of which is an art glass American flag 50 by 20 feet and flags of America and her allies from the main part of scheme of embellishment of the Coliseum. Of the 350 exhibitors 258 are displaying accessories and parts and 92 manufacturers are showing 400 cars and chassis. Three cars not shown at the New York exhibition will be on display—Comet, Pan-American and Maibohm. The Deering-Magnetic will be at the Salon. There will be more dealers' meetings and conventions than at New York, the most important of which is the war dinner at the Society of Automotive Engineers, at which 1500 people will be present.

—

Urge Use of Trade Acceptance on Government Work

NEW YORK, Jan. 22—The American Trade Acceptance Council, of which Lewis E. Pierson is chairman, is urging that authorities in Washington insist upon the use of Trade Acceptance by manufacturers doing government work. The council would like the government to adopt the policy of refusing to approve advance payments until the applicant has availed himself of his own credit possibilities by using the Trade Acceptance in the purchase of raw materials. It is pointed out that the government cannot itself pay for goods on the Trade Acceptance plan because of legal obstacles.

—

Government Help for Small Makers

DETROIT, Jan. 22—Small manufacturers in this vicinity who have been willing to go into war work but have not been able to finance themselves in changing over from their customary lines, have been informed that they will be financed by the U. S. Treasury. Lieut.-Col. Edward Clifford, one of the three members of the War Credits Board, is now here to describe such credit arrangements.

When a concern that has a contract for war supplies has shown the board that it needs financial assistance it will receive the money without delay, although the board does not act in any sense as a bank. Colonel Clifford states that it is only when the manufacturer has reached the point where financial assistance is needed in addition to his banking lines, that application for advance payment for his goods should be made to the board.

—

Detroit Will Recruit Motor Mechanics

DETROIT, Jan. 21—It is expected that a considerable percentage of the two regiments of motor mechanics needed by General Pershing will be recruited from Detroit. The Detroit Automobile Club is co-operating in securing the right kind of men for this work. The two regiments must be filled by Feb. 1. The request for these men was forwarded to H. G. Batchelder, executive chairman of the A. A. A.

Automobille mechanics capable of working on high grade gas engines are desired. About 60 per cent of the men will be made non-commissioned officers.

Fuel Situation Not Improved

Five-Day Shut-Down Fails to Relieve Shortage—Labor Problem is Serious

NEW YORK, Jan. 24—Following the general closing down of industries following Fuel Administrator Garfield's order, conditions are quieting somewhat and a canvass reveals that the order has not resulted in the increase in fuel that was hoped for and that freight conditions have not materially improved. Following are a number of telegrams which give the situation at the present moment:

DETROIT, Jan. 23—Net result of 5-day shutdown was diversion to domestic users of 105 cars of coal. In spite of this, unfilled domestic orders are 60 per cent more to-day than they were at the beginning of shutdown period. Besides this no headway has been made toward opening free passages for empty coal cars over roads south of Toledo, and all indications point toward a continuance and even an intensifyig of existig shortage.

Daily average of coal for 5 fuel holidays arriving in Detroit was 563 cars. This is about equal to normal conditions and showed that shutdown did not increase coal receipts as expected. Eighty per cent of coal coming through Toledo gateway is consumed in Detroit, remainder going to other sections of Michigan, so that all sections suffered proportionately. Needs of city are 700 cars daily, so that receipts have been 36 per cent below requirements. Detroit Edison Company, which furnishes most of plants with power, reported a saving of 40 per cent or 850 tons on Monday, as compared with normal days.

One of the biggest problems here has been to get the men engaged in war work back to their places. It was feared for a considerable time by plants which have been forced to close that the companies engaged in war work would hire the men who had been temporarily thrown out of employment by the edict, thus making them short in lines where there is an active demand for labor. This has not been done, however, to any extent.

Manufacturers are making every effort to speed up production in an effort to make up in some degree for the curtailment of the last 5 days, and it is very probable that big shifts of men will be employed on overtime work.

INDIANAPOLIS, Jan. 23—Conservative estimates to-day placed the number of men laid off from work in atomobile factories at from 2500 to 3000. As a result of exemptions from the order to companies engaged in manufacturing motors and trucks for army about 4000 men were kept working; about 3000 men engaged in work subsidiary to the manufacture of cars were laid off. The Weidley Motor Co., engaged in manufacturing motors for the Cleveland Tractor Co., and the Lyons-Atlas Co., engaged in manufacturing trac-

(*Continued on page* 246)

Automotive Industries

May Concentrate on Liberty Engine

Plane Building May Be Done Abroad—Doubt Efficiency of Drastic Fuel Order

WASHINGTON, Jan. 24—Howard E. Coffin, head of the Aircraft Production Board, in an interview yesterday stated that in the event of scarcity of tonnage the United States would manufacture only Liberty engines and parts, leaving to foreign governments the production of planes, for which they are well equipped. He also stated that the aviation departments of the United States Government which, only 3 months ago contained but 330 men, now include 90,000 men. Coffin states that excellent progress is being made with aircraft work and that planes are being supplied our men in France and England on foreign contracts.

The fuel order has aroused considerable speculation and several high officials who favored the order are now in doubt as to whether it has accomplished the hoped-for result. There are rumors that a similar order may be issued again in the near future for another five-day heatless, workless period. It is stated also that the single heatless Monday for the next 9 weeks may be curtailed by March 1.

—

Industry Calls Washington Conference

WASHINGTON, Jan. 24—There is to be a special meeting of the directorate of the National Automobile Chamber of Commerce and the Motor and Accessory Manufacturers' Association here to-day. The exact purposes of the meeting are unknown but it is understood that there will be conferences between representatives of the automobile industries with Director of Railroads McAdoo and Fuel Administrator Garfield.

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Class AA Truck Nearly Ready

TOLEDO, Jan. 23—Special Telegram—The Class AA Quartermaster's truck which is being assembled here at the plant of the Willys-Overland Co. is completed except for the front and rear axles which are due to arrive from the American Ball Bearing Co., Cleveland, tomorrow. The engine and gearset are in and the frame is up on wood horses. Assembly was started two weeks ago and all parts are going together nicely.

—

Continue Copper Price at 23½ Cents

WASHINGTON, Jan. 24—The President has approved the recommendation of the War Industries Board that the maximum price for copper, which was fixed on Sept. 21 at 23½ cents per lb., be continued under the same conditions until June 1, when another revision may be made. Following the action of the War Industries Board on Sept. 21, copper producers met in New York on Sept. 28 and formed the Copper Producers' Committee on which is represented all copper producers. This committee is at present handling the entire distribution of copper, both foreign and domestic. In 1916 the amount of smelter copper produced was 1,942,776,309 lb. as against 1,888,395,945 in 1917, which is a decrease of 54,380,364 lb. Refined copper, on the other hand, increased in 1917 by 50,240,606 lb., the 1917 figure being 2,350,240,606 lb. as against 2,300,000,000 in 1916. Prior to the fixation of the price at 23½ cents copper had been selling at from 26 to 27 cents.

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Joy to Retire from Lincoln Highway Presidency

DETROIT, Jan. 23—Henry B. Joy will retire from the presidency of the Lincoln Highway Assn., and it is rumored that F. A. Seiberling is slated as his successor. A meeting of the association will be held Saturday, at which the members will talk over the advisability of continuing road work in Utah and Nevada. Seiberling contributed $100,000 for this work, John N. Willys $50,000 and Carl Fisher $25,000.

—

N. A. C. C. Wants Better Export Service

WASHINGTON, D. C., Jan. 18—The National Automobile Chamber of Commerce through its general manager, Alfred N. Reeves, has asked for improved export service from the Department of Commerce. C. P. Carter, Assistant Director of Foreign and Domestic Commerce, in consequence, is arranging to provide more complete business information of all foreign countries to the automobile industry. Mr. Reeves is preparing a list of the kind of information required, including road conditions, financial conditions, gasoline supply, motor supplies markets, kind of people who may be secured as agents, methods of business as regards cash or credit, and so forth. As soon as this list is compiled Mr. Carter will secure the desired information and will endeavor in the future to frequently supply the industry with additional data along the same lines.

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Church-Ward Leaves A-B-C Starter

DETROIT, Jan. 23—Alexander Church-Ward has relinquished his interest in the A-B-C Starter Co. and is no longer connected with that concern. At present he is engaged in consulting work of an electrical engineering nature.

Trucks Might Carry Ship Parts

Thousands of Vehicles Driven Overland Could Take Parts from 1600 Makers

WASHINGTON, Jan. 22—The thousands of war trucks to be manufactured in the great manufacturing zone of the Great Lakes might be utilized to advantage when being driven overland from that region to seaport to carry smaller parts needed in our ship building program. The original plan of carrying only spare parts in these trucks can readily be modified to embrace the urgent shipbuilding program.

For example: There are 200 companies in Detroit manufacturing parts of one kind or another that find a place in our ship-building program. In Michigan there are 400 such companies. There are more than 1600 in the five states of Michigan, Ohio, Indiana, Illinois and Wisconsin, all manufacturing small parts for shipping, and many of which might be transported overland in our war trucks.

It will be an example of that necessary war efficiency and co-ordination of efforts if co-operation along the following lines might be had.

The Quartermaster Corps instructs all its truck builders to direct the trucks en route to load and carry the parts needed by the shipbuilders.

The Highway Transport Committee creates routes so that the Quartermaster trucks can leave the various factories in which they are made, travel to the factories making ship parts and thence to the eastern seaboards with the least delay.

The trucks being manufactured for other divisions of the army exclusive of the Quartermaster Corps and including such as the Signal Corps trucks could also be used in such a plan as this.

The Shipping Board arranges with its manufacturers to deliver parts to Quartermaster trucks.

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No New Liberty Engine

WASHINGTON, D. C., Jan. 22—The Aircraft Production Board declares that the story of a new Liberty motor which is being designed to surpass the present Liberty motor is entirely without foundation. The story has appeared in the general press throughout the United States and was to the effect that new mechanical innovations were to be used and that the present Liberty engine would be inferior to the new one. Howard E. Coffin says that the report is to be entirely discredited and has no foundation.

490,000 Vehicles in Great Britain

Scarcity of Fuel Puts 80% Out of Commission—Motorcycles Number 200,000

LONDON, Jan. 23—*By Cable*—There are approximately 490,000 motor vehicles in Great Britain to-day made up as follows:

Trucks, including delivery wagons	40,000
Automobiles	250,000
Motorcycles	200,000

These figures include vehicles in government use as well as those in private service. A considerable percentage of these vehicles are not in operation, due to the scarcity of fuel as well as legal restrictions. It is estimated that the percentages of these vehicles not in use, due to these causes, are:

Trucks, including delivery wagons	10% idle
Automobiles	80% "
Motorcycles	80% "

These figures are not official, but are the best estimates obtainable. It is difficult getting the exact figures because annual registration of vehicles is not required and hence there may be many so-called dead vehicles included in these figures. The percentages of vehicles not permitted to operate are substantially correct.

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Detroit Sees Sales Boom

DETROIT, Jan. 19—Detroit's Seventeenth Annual Automobile Show, and in many respects the best ever held here, opened to-day in the new Overland building. Three floors have been utilized to display a very representative line of automobiles, trucks and accessories. There are 100 exhibitors, fifty of whom are showing passenger cars, twenty are showing trucks, and the remaining thirty, accessories. There are 230 cars on the floor. The show is held under the direction of the Detroit Automobile Dealers' Association and the exhibit space totals 75,000 sq. ft.

Detroit and the territory surrounding it is going to be one of the greatest buying centers in the United States during the coming year. It is estimated that due to war work the amount of money spent in local industrial establishments will be 300 per cent greater in 1918 than it was in 1917. Michigan, the automobile manufacturing center, has already taken a prominent place in the airplane industry, and under the spur of government needs for the prosecution of the war, great plans have already been established to manufacture airplanes and airplane parts, so that this state is well on its way to rank first in the United States in airplane production.

The Lincoln Motor Co. rapidly nearing completion, promises to be the largest plant in the country for the making of Liberty engines. The Ford Motor Co. is not only making in excess of 100,000 airplane cylinders, but is also making the Liberty engine complete. The furniture factories of Grand Rapids have recently pooled their facilities for the manufacture of airplane frames, and propellers. The Fisher Body Co. of Detroit is rushing to completion a 10-acre plant for the manufacture of airplanes and has already finished its first complete production plane. The Anderson Forge & Machine Co. is making crankshafts for the Liberty engine.

—

Factory Efficiency Discussed

CHICAGO, Jan. 19—The fundamental principles underlying factory reproduction and motion pictures illustrating the rigorous tests to which the Holt caterpillar tractor was subjected to by the various departments of the army, constituted last evening's program of the Mid-West section of the Society of Automotive Engineers.

F. A. Carlisle in his paper on "Efficiency in Factory Reproduction" contrasted the present-day methods and workmen with those of former years in regard to accuracy, speed, etc., concluding that the present-day workman was made more efficient than the old craftsman by reduction of waste motion, proper tools, less fatigue and in some instances even his social well-being was considered, all of which tend to promote speed and accuracy in production. In closing, the necessity of the planning department to facilitate production in the correct amount and at the correct time was discussed.

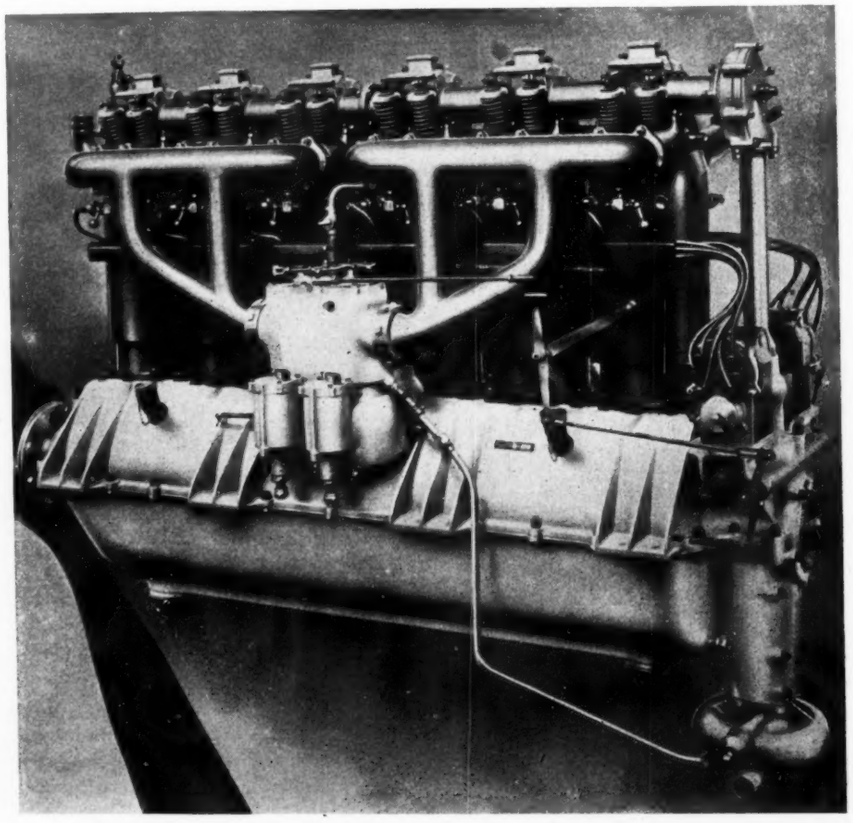
New Altitude Record Made by Italian

Lieut. Brak-Papa in Sia-Fiat Biplane Climbs to Height of 23,048 Feet

TURIN, ITALY, Dec. 22—On the military aerodrome in this city Flight Lieutenant Francesco Brak-Papa has established a world's height record with one passenger by climbing to an altitude of 23,048 ft. in 1 hr. 3 min. The machine, a Sia-Fiat biplane built in the shops of the Fiat Automobile Co., carried a useful load of 792 lb.

The climb was made at the following rate: 3280 ft. in 2 min. 30 sec.; 6562 ft. in 5 min.; 8942 ft. in 9 min.; 13,123 ft. in 15 min.; 16,400 ft. in 24 min.; 19,685 ft. in 37 min. 30 sec.; 21,325 ft. in 45 min., and the maximum height of 23,048 ft., as stated, in 1 hr. 3 min. The previous record, which was also held by Lieutenant Brak-Papa, was 21,161 ft.

The motor with which the record flight was made is a standard six-cylinder vertical Fiat with a cylindrical capacity of 1324 cu. in. and developing 300 hp. The motor has four valves per cylinder and direct mounted propeller. Cylinders are of steel with welded-on sheet steel water jackets. The same type of motor is used by the American army in France.



The 300 hp. Fiat aviation motor which established the passenger-carrying height record of 23,048 ft. in 1 hr. 3 min.

French War Trucks Aid Business

Army Convoys Carry Troops in One Direction and Merchandise in Opposite

By W. F. Bradley

PARIS, Dec. 22—In order to assist as far as possible to relieve the shortage of freight, the French army transport service undertakes the haulage of privately owned goods under certain circumstances. As examples, the town of Lyons, 300 miles southeast of Paris, receives large numbers of trucks and automobiles from the Lyons and Italian factories, and has to equip these vehicles and send them out to the front or to the neighborhood of the capital. It is now the general plan to send these truck convoys to Paris by road and to accept general freight for them. The public is informed from one to two weeks in advance of the departure of a convoy, the available tonnage, and the date of reception of the goods to be hauled. The price charged is 6 cents per kilometric-ton, packages not to exceed 141 cu. ft. each, and load to be not less than half a ton for any one destination or consignee. Goods are accepted for three towns en route, Chalon-sur-Saone, Auxerre and Fontainebleau. On reaching Paris the trucks go direct to the state aviation factory, where goods are unloaded. They must be called for at this place by the persons to whom they are consigned.

A similar system of public haulage by army trucks has been in force for some time between Havre and Paris and St. Nazaire and Paris, the respective distances being 120 and 250 miles. American trucks are used for this work. Formerly all these trucks were brought up by rail, then by road empty, for the army rarely had any freight to give them. By accepting commercial freight the railroads are relieved and goods are brought up with the least possible delay.

Modern Marine Engines at Motor Boat Show

NEW YORK, Jan. 22—The fourteenth annual motor boat show was opened here on Saturday last at the Grand Central Palace by the National Assn. of Engine & Boat Mfrs., of which John J. Amory is president. The exhibition occupies the ground floor and second floor.

Among the engines shown may be found all types from the small single cylinder outboard motor designed to be attached to canoes, to racing engines of over 300 hp., examples of the latter type being shown by the Duesenberg Motors Corp. and by the Murray & Tregurtha Co. In the Duesenberg exhibit is an eight-cylinder patrol model 360 hp. marine engine and a six-cylinder patrol model 260 hp. marine engine; the Murray & Tregurtha Co. exhibit a 300-400 hp. six-cylinder engine with double valves in the head. The latter has a bore of 7¼ and a stroke of 9 in. and is fitted with two two-spark magnetos and with four spark plugs in each cylinder.

A considerable number of marine engine manufacturers and motor boat builders are engaged in Government work on submarine chasers, motors and equipment of various sorts, and some of the engine builders also are manufacturing aircraft engines. The Duesenberg Co. shows two types of airplane engines, the four-cylinder type already described in these columns and a twelve-cylinder 300 hp. type.

French Engineers Plan Congress

To Be Held at the Sorbonne, Paris—Paper on Industrial Questions to Be Read by Lumet

PARIS, Jan 3—The civil engineers of France are to hold a congress at the Sorbonne, Paris, in March. The third section, which covers the entire question of transportation, has one sub-section dealing with the automobile industry. M. Lumet, who before the war was engineer of the laboratory of the Automobile Club of France, and who will be remembered as the first officer sent to America to purchase army trucks for the French forces, will present a paper dealing with "Industrial Questions: Manufacturing, Standardization, Methods of Work and of Production." Henri Cezanne, who in peace days was general manager of the Paris Automobile Salons, and is still general secretary of the French Automobile Manufacturers' Association, has been scheduled to read a paper entitled "Commercial Questions: Sale, Exchange, Customs Duties, Taxes, Production Combines."

Other papers will be read as follows:

"Best Methods of Developing the Use of Internal Combustion Motors in the Merchant Marine Service," by M. Lumet.

"Formation of Engineers and Technical Employees for the Aviation Industry," by Colonel Roche.

"Aviation Motors," to be dealt with by a commission of which M. Soreau will be the president.

"The Possibilities of Aviation After the War," by Colonel Espitallier.

French automobile column traveling by road from the French to the Italian front. Note that each truck has a trailer. In every convoy of 20 trucks one trailer is a workshop and another a kitchen

Canada Has 199,302 Cars and Trucks

1917 Figures Show Great Increase in Registration, Trade and Capital

MONTREAL, Jan. 21—There are now registered in the Dominion of Canada 199,302 cars and trucks. In several of the Provinces registrations are closed on Oct. 1, and in others the figures will be somewhat increased when full returns are available. There is owned and operated in Canada one car for less than 40 of population, as compared with a ratio of one to 60 shown by last year's figures.

The sale of cars in Canada during 1917 has been marked by a more general distribution throughout the country than in any previous year. Particularly in the West has this been noticeable, but it is apparent that all rural communities have been large buyers, whether due to the increasing measure of prosperity enjoyed by the farming classes, by the intensified good roads propaganda or by the general campaign of motor car education.

There were brought into Canada during the first 6 months of the present fiscal year, April to September, 1917, inclusive, motor vehicles, parts and tires, to the value of $13,144,405. This compares with a total of $17,056,685 for the fiscal year ending with March, 1917, but it will be seen that the imports of passenger cars in the 6 months almost equalled those of the entire preceding year, while the value of commercial vehicles brought in almost doubled, and that of tires imported showed a marked increase.

The record of exports shows a more uneven tendency, the volume for the first 6 months of the fiscal year ending March, 1917, being but slightly in excess of that for the year ending March, 1915. The 12 months ending March, 1916, showed the greatest activity in the Canadian export trade, the figures then going over the $10,000,000 mark, and very closely approximating the value of imports during the same period. The increasing difficulties of transportation, however, seriously interfered with the development of this branch of the business with the result that the succeeding years show a pronounced falling off in the volume of trade.

Definite figures as to the value of the product of Canadian automobile factories are not available since 1915, but an interesting comparison illustrating their growth may be had from the statistics of the Government census of 1910 and the special business census taken in 1916 for the preceding year. This is given in the following table:

Factories.	1910	1915
Establishments	8	8
Capital	$361,272	$3,540,441
Salaries, wages, etc.	903,349	3,427,146
Cost of materials...	3,808,139	16,739,643
Value of product...	6,251,885	24,357,627
Repairs, Accessories, Etc.		
Establishments	11	120
Capital	361,272	3,540,441
Salaries and wages.	76,060	1,152,585
Cost of materials ..	40,893	2,434,197
Value of product....	170,930	4,329,938

There are now 12 automobile factories in operation in the Dominion, and while the number of accessory manufacturers can only be estimated, it is worthy of note that their growth has been most marked during the past three years, and they are now believed to be supplying 20 per cent of the total demand for automobile supplies and equipment within the Dominion. This is, of course, outside of the tire business, which is now almost controlled in Canada for the Canadian trade.

Few Separate Records

Consideration of the manner in which the motor truck business has grown in Canada is rendered difficult by reason of the fact that few of the Provinces have, in the past, kept separate records of the passenger and commercial car registrations. The first record in Ontario is for the year 1916, when 2786 trucks were reported, but this has been increased in the present year to 4590, showing a percentage of increase almost identical with that in the case of passenger cars. Quebec also shows a steady growth in the number of commercial cars registered, having had 384 in 1914, 528 in 1915, 729 in 1916, and 1080 in 1917, so far as has been reported. As in the case of Ontario, the truck registrations are in the neighborhood of 5 per cent of the total, so that it may be assumed that Canada has no less than 10,000 trucks in operation.

The commanding position occupied by the Province of Ontario in the motor car trade is evidenced by the fact that almost one-half of the total registrations are credited to this Province. Perhaps a pronounced factor in this situation is that all of the twelve companies now engaged in the manufacture of automobiles in Canada are located in the Province, and this fact has also served to attract by far the greater proportion of accessory manufacturers. The progress of the good roads movement has also rendered Ontario a very fertile field for the automobile agent, and rural communities have of late become very liberal purchasers.

The City of Toronto is credited with having 17,500 cars in operation, Hamilton with 5000, Ottawa and London with 3000 each, and Windsor with 2500. Outside of these large centers, the distribution is considered to be very even throughout the Province.

In the matter of percentage of increase for the year, the little Province of Prince Edward Island has the lead, having six times the number of cars it had in 1916, when only fifty were registered. This was, of course, due to the oppressive regulations, it being permissible to use cars only on certain days of the week and only on certain roads. But the breaking down of prejudices has been working gradually, and there are now 301 cars on the island, including six motor trucks.

The prairie provinces have also showed up remarkably well, the prosperity of the farmers being responsible for doubling the number of cars in Alberta and Saskatchewan. Manitoba has made almost a 50 per cent increase, while British Columbia has added about 35 per cent to its quota.—*Toronto Globe.*

AUTOMOBILE REGISTRATIONS IN CANADA

Year	Ont.	Que.	N. S	N. B.	P.E.I.	Man.	Sask	Alta.	B. C.	Total
1903	220	.....	....	....	...	.....	.....	.....	.....	220
1904	535	.....	....	....	...	.....	.....	.....	.....	535
1905	553	.....	....	....	...	.....	.....	.....	.....	553
1906	1,176	.....	....	....	...	.....	.....	41	.....	1,217
1907	1,500	254	62	....	...	.....	54	55	175	2,100
1908	1,700	296	45	104	...	412	36	45	263	2,901
1909	2,400	485	69	167	...	662	149	275	504	4,711
1910	4,200	786	148	299	...	1,524	531	423	1,026	8,937
1911	11,339	1,878	228	483	...	2,599	1,304	1,631	2,220	21,682
1912	16,266	3,535	456	700	...	4,770	2,268	2,505	4,289	34,789
1913	23,700	5,452	511	824	26	5,406	4,659	3,773	6,138	50,489
1914	31,724	7,413	544	1,260	30	7,001	8,027	4,728	6,688	67,415
1915	42,346	10,112	971	1,900	35	8,812	10,225	5,832	7,440	87,673
1916	54,375	15,347	1,728	2,986	50	11,953	15,600	9,703	8,576	120,318
1917	84,353	21,702	5,678	5,249	301	17,333	32,500	20,800	11,386	199,302

CANADIAN MOTOR VEHICLE IMPORTS AND EXPORTS

IMPORTS.

	1915	Fiscal years ending 1916	1917
Automobiles	$	$	$ 7,981,177
Motor trucks	.....	.....	423,824
Motor vehicles, all kinds	4,888,704	5,089,349	177,624
Parts	2,166,193	4,550,486	7,200,017
Tires	1,204,457	1,418,279	1,274,043
	$8,259,354	$11,058,108	$17,056,685

EXPORTS.

	1915	Fiscal years ending 1916	1917
Motor vehicles, all kinds	$3,290,234	$ 9,223,813	$ 5,637,465
Parts	607,331	745,015	1,418,299
Tires	278,442	568,274	773,259
	$4,176,007	$10,537,102	$7,829,023

Receiver Named for Bijur

Assets Exceed Liabilities by $1,100,000—Expect Quick End of Receivership

NEW YORK CITY, Jan. 18—A receiver was appointed to-day for the Bijur Motor Lighting Co., manufacturer of Bijur starting and lighting apparatus, this action being taken by Jos. Bijur, president of the company, after discussing the affairs of the organization with the major creditors. A committee of three receivers has been appointed, and the factory is being operated under this committee. Before the receivership action was taken, a meeting of the creditors, representing merchandise interests, was held, and this committee was of the opinion that the best interests of the creditors would be served by continuing the business, because the balance sheet shows that the company is solvent. The present difficulty, in the opinion of the creditors, has arisen from a large expansion of business, and a lack of working capital.

During the last 4 or 5 months the company has made heavy purchases of machinery, all of which is installed, being operated, and largely paid for. Perhaps the heaviest handicap the Bijur company has had to contend with is the merchandise account, which, in the condensed statement issued by the committee, is placed at $840,652. A year ago the merchandise on hand did not represent one-half this amount, or was $440,000 less than at present. The heavy merchandise account at present is due to reduced shipments of starting and lighting apparatus due to the slack in automobile manufacture. The Bijur company, while accommodating its customers by slowing up shipments in response to their requests, had contracted for its materials at advantageous prices and received them on regular schedule.

Besides several million dollars' worth of back orders for their regular equipment for automobile manufacturers, the Bijur company has orders for thousands of generators for the U. S. war trucks, and large contracts for miscellaneous articles for the Navy and Ordnance Departments. The factory is being continued at normal production on all of its domestic and Government orders. Inasmuch as the present assets of the company exceed the liabilities by $1,100,000 and at the time of its receivership the company had over $200,000 in the bank, and as the business has shown an increasing profit every quarter since its beginning in 1910, the last quarter of 1917 showing the largest profit in the history of the company, it is expected that the receivership will be of short duration.

The receivers appointed by the Court are: Joseph Bijur; Louis V. Hubbard, president of the Taft Pierce Co., Woonsocket, R. I., a director in several banks, and representing the banking interests; and E. B. Wilson, attorney, New York City, representing the creditors.

The Bijur plans for expansion were started in November and December, 1916, and included a new factory, which tripled the previous capacity, new machinery, which was four times greater than the previous amount used, and corresponding increases in organization to care for this expansion, and which was justified by the ability of the concern to execute orders offered to it. The factory was finished March 1, 1917, and is now operating with a force of 1100 to 1200 men as compared with 300 to 400 a year ago.

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Stutz Earns $1,074,778

NEW YORK, Jan. 24—Stutz Motor Car Co. in the year ended December 31 earned net profits of $1,074,778, an increase of 65.6 per cent over 1916.

Output of cars in 1917 was 2207, compared with 1535 in 1916, 1079 in 1915, and 649 in 1914.

Output in 1917 increased 43 per cent, and it is officially stated that the entire maximum output for 1918 has already been sold.

Balance sheet as of Dec. 31 shows current assets of $1,455,098, compared with current liabilities of but $352,912, or a net working capital of $1,102,186. Net quick assets alone, excluding plants, equipment and good will are equal to $14.70 a share. Total selling, administrative and general expenses for the year were but $77,637.

Comparison is made below of the results for the calendar year 1917, with the seven months period ended Dec. 31, 1916:

	1917	1916 7 months
Net sales	$4,483,315	$1,771,328
Cost of manufacture	3,375,980	1,374,066
Gross profit	1,107,334	397,261
Selling and gen'l exp.	77,637	44,747
Balance	1,029,697	352,513
Int. and dis. earned	45,081	28,547
Net profit	1,074,778	381,061

Comparison of the balance sheet as of Dec. 31, 1917, with that of Dec. 31, 1916, follows:

ASSETS

	1917	1916
Fixed assets	$2,560,731	$2,431,603
Cash	252,811	74,059
Receivables	53,816	145,530
Inventory	1,148,470	577,248
Total	$4,015,829	$3,228,441

LIABILITIES

Payables	$317,462	$356,980
Deposits on cars	35,450	17,700
Taxes	6,000	8,500
Reserves	*59,491	31,329
Surplus	3,222,425	2,439,021
Capital at $5	375,000	375,000
Total	$4,015,829	$3,228,441

*Reserve to meet Federal taxation not included, as the amount has not yet been definitely determined.

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Seigle Vice-President of Johns-Manville

NEW YORK, Jan. 22—At the annual stockholders' meeting of the Johns-Manville Co. yesterday, William T. Klauss was elected a director. Other directors were re-elected. At a subsequent meeting of the board of directors W. R. Seigle was elected vice-president. Other officers remain the same.

War Committee for Rubber Trade

To Be Point of Contact Between Government and Industry—B. G. Work, Chairman

NEW YORK, Jan. 22—The Rubber Assn. of America, Inc., has appointed a War Service Committee, representing the entire industry, with the following members: B. G. Work, president of the B. F. Goodrich Co., Akron, chairman; H. S. Firestone, president of the Firestone Tire & Rubber Co., Akron; James N. Gunn, president of the United States Tire Co., New York; G. B. Hodgman, president of the Hodgman Rubber Co., New York; and P. W. Litchfield, vice-president of the Goodyear Tire & Rubber Co., Akron.

Some of the functions of the war service committee will be to act as a point of contact between the industry and the Government; to supply information as to the ability of the industry to serve the needs of the Government in carrying on the war; to supply statistics regarding rubber; to co-operate in the standardization of specifications and products for Government use; to assist in the speedy and efficient production of Government requirements, and to put before the Government the needs of the industry at all times.

To help carry out these functions subcommittees will be formed to represent the various branches of the industry. Among these will be committees on pneumatic tires, solid tires, mechanical goods, medical goods, boots, aircraft, gas defense, reclaimed rubber, hard rubber goods, crude rubber and kindred products, foreign trade, statistics, supplies and reports. There will be technical as well as commercial committees on the various sub-divisions, to insure a balance of attention.

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Bosch Must Pay Rushmore $100,000

NEW YORK, Jan. 21—The Bosch Magneto Co. has been directed to pay Samuel W. Rushmore, inventor of the Rushmore starter, $100,000 for breach of contract in that the Bosch company failed to use the name "Rushmore" in its advertisements of Rushmore starters. According to the contract, the Bosch company was to describe the starter sold as the "Rushmore Starter" or the "Bosch-Rushmore" starter or "System Rushmore," failure to do so involving a penalty of $100,000. Judge Hand has decided that the Bosch company broke its contract and ordered it to pay Rushmore the $100,000. The Bosch Co. will appeal the case.

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Dayton-Wright to Build

DAYTON, OHIO, Jan. 23—The Dayton-Wright Aeroplane Co. will start work shortly on a factory 300 by 600. The structure will be 2 stories and will cost $200,000.

Boston Would Solve Freight Tangle

Propose 2 Weekly Trains to New England — Discuss Show Postponement

BOSTON, Jan. 19—The possibility of putting the Boston Motor Show back to the last week in March instead of the first, and a plan to have a committee of The Boston Automobile Dealers' Association handle two trains weekly from the motor centers carrying cars and trucks, were discussed at a meeting of the Board of Directors of the organization yesterday. After a full discussion of the matter it was voted that unless something extraordinary happened the present dates would be adhered to, but provision was made for a change if it seemed advisable.

The other matter was outlined by President MacAlman. He stated that he had been informed that there was a possibility of the government shutting down on all shipments of motor cars and trucks from factories to dealers. In addition to that there was talk of a transportation chief being placed in the motor centers to see that every motor vehicle leaving a factory carried something along in the way of parts, tires, etc. In other words, nothing would be allowed to move unloaded. As the government talked of taking over the express companies that avenue would be shut off.

Therefore he offered for discussion the suggestion that the organization consider a plan whereby it would appoint a committee to work with the transportation committee of the Boston Chamber of Commerce and try to have two trains weekly brought to Boston carrying motor cars and trucks. The committee would pledge the government to unload the vehicles on arrival so the freight cars would be available for return shipment immediately.

To Help Government

It was pointed out that this would be a means of aiding the government. If the trains could not be brought to Boston the committee would be satisfied to have them stop at Albany, and men would be there to take care of the unloading. Under the plan the dealers wanting cars would have to deposit with the motor committee the money to release the cars on arrival. No attempt would be made to play favorites, and the requests for space in the trains would be granted according to the receipt of application. The dealers would be given such space as would allow the greatest number to get some cars regularly instead of any one company to get a large number in one shipment.

As Albany is like the neck of the bottle leading to New England, it was felt that perhaps the government would be willing to go as far as that city with trains. By getting at least two a week through it would be possible to take care of a large number of dealers all through the territory.

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Haynes Prices Increased

KOKOMO, IND., Jan. 19—Factory prices of all Haynes models have been increased as follows:

Model	New Price	Old Price
39—4-pass. roadster (formerly Model 37)	$1,825	$1,725
38—5-pass. touring (formerly Model 36)	1,725	1,595
39—7-pass. touring (formerly Model 36)	1,825	1,725
39—Sedan (formerly Model 37)	2,585	2,390
44—7-pass. touring (formerly Model 41)	2,785	2,295

In addition, the following new models are being built:

Model	Price
44—Sedan (12 cyl.)	$3,385
44—Coupe (12 cyl.)	3,335
44—Town car (12 cyl.)	3,985
39—Coupe (6 cyl.)	2,535
39—Town car (6 cyl.)	3,250

The prices of all touring models will be increased an additional $125 on March 1. Cars leaving the factory up to that date will be charged for at the present rate, but after March 1 even if ordered in advance, the new price will hold.

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Fuel Situation Not Improved

(*Continued from page* 240)

tors, received notice of exemptions from the closing orders late Monday.

KANSAS CITY, Jan. 24—Ford assembling plant shut down Tuesday and Wednesday for lack of material. Two hundred and fifty men idle without pay; no shutdown through coal shortage or Administrator's orders.

ST. LOUIS, Jan. 23—St. Louis was not in 5-day suspension district and only one motor factory on the east side was affected. Men here strongly favored shutdown, as their business has been seriously affected by failuse to get supplies from the East.

MINNEAPOLIS, Jan. 24—General resumption of industries to-day. No such shortage of fuel here as in East, and Great Falls, Mont., to-day offered 2000 tons daily. Farm machinery for spring use now exempted and Fuel Administrator wired Washington to know if tractor plants are included.

CHICAGO, Jan. 24—Plants in this territory affected by Monday closing as follows: Stromberg, Elgin and Case closed; Root & Vandervoort closed, but has 80 per cent Government work; Nash, Velie, Nordyke & Marmon open on Government work; Parrett and Waukesha engine all open, former on tractors for spring deliveries, latter on Government work; Diamond T closed, but has Liberty truck orders; Findeisen & Kropf, indirect Government orders, closed; Old Reliable, closed; Wisconsin Motors, Government orders, open; National, closed, except departments on Government orders; Mitchell, Government truck plant open; Emerson-Brantingham, same as Parrett; Hayes Machinery Co., closed; Kissel open on Government work; Haynes closed, but just started on Government work that may exempt them; Four-Wheel-Drive shut down Friday, but resumed operations Monday on Government orders; Holt did not shut down because of Government work; Stutz, closed; Wheeler & Schebler, closed; Prest-O-Lite, open for Government work.

England Protests at Curtailment

Motor Trade Assn. Gives Reasons Why Handicaps Should be Removed by Government

LONDON, ENGLAND, Jan. 1—An additional protest against the enforced curtailment of the automobile industry in Great Britain has been made by the Motor Trade Association, which represents the motor industry in its entirety. The protest sets forth the various reasons why the industry should not be handicapped as it has been, and advances information as to the essential characteristic of the industry in war times. In this connection the protest states:

"The rich man to-day represents the smallest fraction of the total motoring class of England. The vast majority, even of private motorists, use their vehicles for other than purely pleasure purposes. Far and away the largest proportion of motor vehicles are directly or indirectly in use for business and utilitarian purposes. Most of these vehicles are of moderate or low price and power, purchased because they represented economy of transport for persons and for goods."

The protest goes on to show the present numerical comparison between automobiles owned in Great Britain and those owned in the United States, and says that while the population of the United States is only twice that of Great Britain, the number of automobiles employed is five times greater. It follows this up by stating that there is a potential motoring population of England which is equal to several times the quantity of automobiles available.

The protest expresses regret that the automobile industry in England never received the encouragement and fostering facilities that it did in America, and cites that "it should not have been beyond the wit even of statesmen of quite ordinary vision to secure and safeguard sources of fuel supply."

"We therefore suggest," the protest continues, "that the State in its own interest should take the earliest opportunity to reconsider its attitude toward motorists, motoring, and the motor industry.

"The motorists of the country, and the personnel of the motoring industry of the country have made sacrifices equal to any other section of the people. They have rendered that service gladly and thoroughly. They ask for no more reward, or recognition than may properly be claimed by any other body of citizens; but they ask for just that much.

"They protest against being taxed as motorists, after being taxed as citizens, because no other body of citizens is twice taxed in that way. They protest against being dealt with as pariahs, after having rendered special service. They protest against being the only body of road users required, as such, to bear the burden of

road making and maintenance. They protest against a tax on fuel for vehicles admittedly indispensible to national efficiency.

"The motor trade joins with motorists in all their protest, and adds its own against its plants being commandeered and diverted to other uses without guarantees for the future.

"Without losing sight of causes it emphasizes a fact, which is not at all sufficiently appreciated, namely, that through the complete turning off of supplies the motor trade has been destroyed literally by starvation.

"It protests against the efforts which are continually being made to represent motoring in any form, and for any purpose as nationally reprehensible, and the purchase of a serviceable motor vehicle as an unpatriotic act while purchase of expensive clothing, jewels, cigars, wine, and other less serviceable articles is encouraged."

The protest accuses the government of being directly responsible for the high price of gasoline, and declares that this is double the reasonable market price solely because of national neglect to secure adequate supplies.

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Spranger Heads Wheel Company

DETROIT, Jan. 19—At the annual meeting of the Spranger Wire Wheel Corp. the following officers were elected: Dr. N. M. Spranger, president; Jacob M. Schaefer, vice-president; William Finzel, treasurer; John F. Reinke, secretary; John A. Lancaster, Frank Spranger, Christopher E. Stein, Fred R. Schmalzreidt and J. Robert Wilkin, directors. J. Robert Wilkin has been appointed sales manager; Albert J. Hall, assistant general manager; Ed. T. Walling, sales manager and director of purchases.

Light Truck Made by Collier Co.

Single ¾-Ton Model to Sell for $885—Fitted with 3 Types of Body

BELLEVUE, OHIO, Jan. 22—The Collier Motor Truck Co. is manufacturing a single truck model—a three-quarter-ton truck fitted with any one of three bodies and selling for $885. Features of this truck are light weight, flexibility and moderate price.

The Collier truck is assembled from standard units and is designed throughout for heavy duty. A 4-cylinder Lycoming engine with a 3¼-in. bore and a 5-in. stroke is used. Conforming with modern practice, the valve mechanism is entirely enclosed and automatically lubricated. The oil is circulated by a plunger pump and is of the positive feed type. Cooling is by a thermo-syphon, a Zig-Zag tube radiator being used.

Among the engine accessories are a Zenith carbureter and a Connecticut ignition system. The electrical system is particularly complete for truck practice, comprising an Auto-Lite starting and lighting system together with a Willard storage battery.

The gearbox and truck are a unit with the engine, a dry plate Raybestos on steel clutch being used together with a selective three-speed sliding gear set. The drive is taken through a propeller shaft fitted with two universals to the three-quarter floating Salisbury rear axle.

Both front and rear springs are semi-elliptic, the former being 37 in. and the latter 50 in. long. These are special electric furnace steel, and carried on hardened and ground spring bolts fitted with grease cups. The wheelbase of the truck is 118 in. and it is mounted on 32 by 4-in. pneumatic tires. The weight complete is 2600 lb.

As stated, 3 types of bodies are offered, each having a loading space of 7 ft. The first is completely enclosed, the second an open express with driver's cab, and the third is a completely roofed express body.

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Chevrolet Model 490 Prices Advanced

NEW YORK, Jan. 22—The Chevrolet Motor Co. is increasing the price of its 490 model effective March 1. The old and new prices follow:

	New	Old
Touring	$685	$635
Roadster	660	625
Chassis	625	585

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Field Motor Directors Re-elected

GRAND RAPIDS, MICH., Jan. 18—At the annual meeting of the stockholders of the Field Motor Co., capitalized at $300,000, the following directors were re-elected: Joseph Northoek, Byron E. Parke, Charles E. Hall, John Senler, Sr., and E. A. Field.

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Michigan Fees Total $2,471,270.77

LANSING, MICH., Jan. 19—Michigan automobile revenues for 1917 amounted to $2,471,270.77. This amount was divided as follows: Passenger, $2,175,276; commercial, $161,185; motorcycles, $19,194; manufacturers and dealers, $42,394; chauffeurs, $36,550; transfers, $11,534; duplicates, $21,857, and non-residents, $3,269.

Automotive Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co.	48	50	..
*J. I. Case T. M. Co. pfd.	77	79	—10
Chalmers Motor Co. com.	3	6	+2
Chalmers Motor Co. pfd.	..	50	..
*Chandler Motor Co.	72	73	..
Chevrolet Motor Co.	106	110	—2
*Fisher Body Corp. com.	24	34	+1
*Fisher Body Corp. pfd.	73	80	..
Fisk Rubber Co. com.	49	51	+4
Fisk Rubber Co. 1st pfd.	98	103	..
Fisk Rubber Co. 2nd pfd.	60	70	..
Firestone Tire & Rubber Co. com.	98	100	..
Firestone Tire & Rubber Co. pfd.	96	98	..
*General Motors Co. com.	109	111	—4
*General Motors Co. pfd.	81	83	+ ½
*B. F. Goodrich Co. com.	38½	40	—1
*B. F. Goodrich Co. pfd.	94	98	..
Goodyear Tire & Rubber Co. com.	150	154	..
Goodyear Tire & Rubber Co. pfd.	94	97½	+ ½
Grant Motor Car Corp.	2	3	..
Hupp Motor Car Corp. com.	2	3	..
Hupp Motor Car Corp. pfd.	75	83	..
International Motor Co. com.	15	17	..
International Motor Co. 1st pfd.	36	45	+12
International Motor Co. 2nd pfd.	14	17	—3
*Kelly-Springfield Tire Co. com.	42	45	—1½
*Kelly-Springfield Tire Co. 1st pfd.	75	79	—6
*Lee Rubber & Tire Corp.	14	15	..
*Maxwell Motor Co., Inc., com.	25	26	..
*Maxwell Motor Co., Inc., 1st pfd.	57	58½	+ ½
*Maxwell Motor Co., Inc., 2nd pfd.	22	23	+1
Miller Rubber Co. com.	130	140	..
Miller Rubber Co. pfd.	95	98	..
Packard Motor Car Co. com.	88	92	—11
Packard Motor Car Co. pfd.	92	96	..
Paige-Detroit Motor Car Co.	15	17	+1
Peerless Truck & Motor Corp.	16	17	..
Portage Rubber Co. com.	109	111	..
Regal Motor Car Co. pfd.	..	23	..
Reo Motor Car Co.	16	18	..
*Saxon Motor Car Corp.	7	9	..
Springfield Body Corp. com.	..	..	..
Springfield Body Corp. pfd.	..	..	..
Standard Motor Construction Co.	9	10	..
Standard Parts Co. com.	65	70	—5
Standard Parts Co. pfd.	95½	96½	..
*Stewart-Warner Speed. Corp.	46	48	—2
*Studebaker Corp. com.	47	48	—3
*Studebaker Corp. pfd.	91	97	+1
Swinehart Tire & Rubber Co.	16	26	..
United Motors Corp.	20⅝	21	—3
*U. S. Rubber Co. com.	51¼	53	—1
*U. S. Rubber Co. pfd.	94	95	—3
*White Motor Co.	38½	40	..
*Willys-Overland Co. com.	16½	17	—1
*Willys-Overland Co. pfd.	76	78½	—3½

*At close. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	..	9	..
Bower Roller Bearing Co.	19⅜	19⅝	+ ⅞
Chevrolet Motor Co.	105	109	—4
Commerce Motor Car Co.	4	..	..
Continental Motor Co. com.	5½	5⅞	..
Continental Motor Co. pfd.	..	..	..
Edmunds & Jones com.	14	17	—2
Edmunds & Jones pfd.	80	90	..
Ford Motor Co. of Canada	170	178	—25
Hall Lamp Co.	13	14½	..
Michigan Stamping Co. com.	12⅝	13	+ ¼
Motor Products	..	..	..
Packard Motor Car Co. com.	86	..	—3
Packard Motor Car Co. pfd.	91	93¾	+1
Paige-Detroit Motor Car Co.	15¼	16	+ ¼
Prudden Wheel Co.	14¾	15¼	+ ½
Reo Motor Car Co.	16⅜	16⅞	— ⅛

INACTIVE STOCKS

Atlas Drop Forge	..	32	..
Kelsey Wheel Co.	81	88½	+1
Regal Motor Car Co.	..	26½	..

Industrial Review of the Week

A Summary of Major Developments in Other Fields

Little Effect on Steel Industry of Closing Order

With so large a part of their product, particularly in heavy lines, going to the Government or its Allies, or to plants having Government contracts, the iron and steel industries felt less than others the closing down order of the Fuel Administration. Fresh snows and intense cold combined to aggravate the freight blockades, as the order went into effect, and made more difficult any measure of its effects.

It is estimated that the five days ending Tuesday brought a curtailment of 10 to 15 per cent from the already restricted rate of recent weeks. Probably 70 per cent of the blast furnace, open-hearth steel and coke oven capacity was kept in operation, but all Bessemer plants were down, the Government not buying converter product, and only such rolling mills were run as had been engaged in producing for ships and shells, including plate mills and some structural and boiler tube mills.

Not only is there great perplexity owing to the new priorities in fuel, but some observers see the steel trade drifting into a state of helplessness that bodes no good even for some work considered important to the war. Exemptions from the closing order do not meet the case if fuel needed to keep iron and steel works going has been diverted to uses higher up on the preferred list.

There has been prompt and generally strict compliance with the Garfield order not only by producers but manufacturer-consumers of iron and steel. Blast furnaces were considered exempt, and open-hearth furnaces in many cases produced much more steel than would take care of exempted rolled product, the remainder going into stock ingots. Rolling mill operation was much curtailed.

The steel trade sees the bearing of the week's events on the effort at Washington to have steel production and prices put under the same executive control that now exists in food and fuel, opinion being that the chances of the Pomerene bill have not been helped by the results of centralized power over fuel.

As a result of the country's engrossment with the throwing of millions of workers into idleness the steel market has had fewer transactions than in months.

Some agricultural implement manufacturers have come into the market for early requirements in both soft and hard steel bars, on a scale pointing to large production in the coming season. In the automobile trade a rather more hopeful view is taken, some makers looking for about 50 per cent of their normal output.

Government awards are being made on 4400 cars for use in France.

A New Service

¶ Herewith AUTOMOTIVE INDUSTRIES *supplies for the benefit of its readers a general summary of important developments in other fields of business. This is rendered possible by the editorial co-operation of leading industrial publications which are recognized authorities.*

By compressing the general industrial situation into this form we hope to give our readers a clear and comprehensive idea of up-to-the-minute developments which they could otherwise secure only with considerable expenditure of time and effort.

Some buyers of finished steel for commercial uses have found it easier to place contracts for plates, shapes, sheets and bars, and mills have been rather more inclined to accept export business on which permits have been obtainable.

Comment has been passed on the action of the Navy Department in seeking bids on various products included in the official price schedule, but not among the few on which prices were specifically announced by the President. It does not appear, however, that bidders are actually naming competitive prices in such cases.—*Iron Age.*

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Weather Hampers Coal Distribution

A cold wave—the coldest for the season in many years—descended on the country, particularly the region west of the Allegheny Mountains during the week under review. The low temperatures were accompanied with high winds and in some localities heavy snows. This tied up railroad transportation to a considerable degree, and while causing an increased consumption, particularly of domestic fuel, rendered receipts much lighter than normal. The suffering in some localities was intense. Along the Atlantic seaboard in particular the movement of coal was considerably hampered by ice in the rivers and harbors. Baltimore, New York and Boston have been and are still suffering in no small degree from this cause, while Hampton Roads is not without its troubles of a similar nature. Of course, the cold weather exerted an adverse effect on production, and many mines worked only part time, and in many cases only partly manned because of the storm. Conditions in New England, while probably no better, or but slightly so, than a week or two ago, are probably no worse. The priority order granted this territory of 500 cars per day of bituminous coal is certain to have its effect sooner or later, but this effect can not be expected immediately. On the other hand, it is believed in some quarters that the diverting of this coal to New England will adversely affect industries in New York, Pennsylvania and some of the Eastern states, and considerable protest is heard concerning it. It would appear that domestic shortage has been in many instances considerably relieved. In some localities, however, added inconvenience and no small amount of suffering was caused by the severe weather conditions. The improvement in transportation, which was being shown in some of the coal producing districts was, of course, nullified by the cold wave. It is believed, however, that as soon as the weather moderates for any length of time the transportation tangle can be largely straightened out, and this will doubtless, at least in large measure, relieve the present stringency. The drastic rulings of the Fuel Administration concerning coalless days may also exert a more or less potent influence in this direction.—*Coal Age.*

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20,000 Disteel Wheels for Government

DETROIT, Jan. 23 — The Detroit Pressed Steel Co. will build 20,000 disteel wheels for the 1½-ton aviation trucks ordered by the government.

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Rumney Made Lieutenant

WASHINGTON, Jan. 23—Mason P. Rumney, formerly sales manager of the Detroit Pressed Steel Products Co., Detroit, has received the commission of lieutenant in the ordnance department of the United States Army.

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Olds Hampered by Freight Conditions

LANSING, Jan. 23—The Olds Motor Works has enough orders on hand to keep the plant running at capacity during the winter months, but due to the fact that deliveries cannot be made business has had to be held over until conditions improve. Oldsmobiles have been driven to Chicago, Toledo, Grand Rapids and Michigan City, where it is possible to get freight cars, and from these points have been shipped to their destination.

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Paige Profits Over $1,000,000

DETROIT, Jan. 22—Profits of the Paige-Detroit Motor Car Co. for the fiscal year ending Dec. 31 amounted to over $1,000,000, according to a statement at the annual meeting of stockholders to-day. The following directors were re-elected: Harry M. Jewett, Edward P. Jewett, Walter B. Cady, Gilbert W. Lee, Charles B. Warren, Jerome P. Remick, E. D. Stair, Sherman L. Depew, all of Detroit, and George de B. Keim, of Philadelphia. The directors re-elected the officers as follows: Harry M. Jewett, president; Edward P. Jewett, vice-president; Walter B. Cady, secretary; Gilbert W. Lee, treasurer; F. L. Jewett, assistant to president and assistant treasurer.

Car Supply Worries Wisconsin

Dealers at Tenth Milwaukee Show Discuss Ways of Meeting Demand

MILWAUKEE, WIS., Jan. 19—This is the most momentous year in the history of the motor car trade of Wisconsin, as it is for the entire industry of the United States. With the best year on record behind them, Wisconsin distributers and dealers, gathering in intimate conferences at the tenth annual Milwaukee show, which is the yearly opportunity for frank and full discussion and interchange of ideas and opinions, seem to hold but one thought—Will we be able to obtain enough cars to fill our requirements? It is not a question of a market, or ability to sell that market, but a problem of furnishing enough stocks to supply its demands.

Business conditions similar to those which made 1917 Wisconsin's greatest motor year presage an equally great new year, or a greater one, so far as the number of prospective buyers of motor vehicles is concerned. The public purse still is well filled. The inclination to purchase motor cars is stronger than ever, in spite of advancing prices. It is a conservative statement to say that every motor vehicle that the manufacturers put into Wisconsin during 1918 will be eagerly absorbed and there will remain an aching void if the number offered is not greater than it was in 1917.

At this time the Wisconsin average is approximately one car to every 17 inhabitants, the population of the commonwealth being figured at 2,800,000. In 1916 the number of cars averaged one to every 24 inhabitants. This is not the best showing made by any State in the Union, but it indicates that the growth of the use of motor vehicles in Wisconsin is a healthy one, and selling is not being overdone by any means, with no possible likelihood of saturation of market.

Talks with leading distributers and dealers at the Milwaukee show serve to indicate that Wisconsin's record in 1917 represents an achievement. In the face of some of the greatest difficulties that the motor car trade has ever been obliged to meet, in excess of 10,000 cars were sold in Wisconsin than was predicted at the beginning of last year. The conditions under which distributers and dealers worked during the latter part of the period are too well known and understood to make explanation necessary. Yet the total business of practically every dealer showed a very appreciable gain over 1916.

Wisconsin Registration For Six Years

	1917	1916	1915	1914	1913	1912
Motor Cars	164,531	115,637	79,791	53,161	34,646	24,578
Dealers	2,167	1,970	1,582	1,202	1,393	1,052
Motorcycles	8,479	8,958	8,601	7,880	6,120	4,060
Increase in Motor Cars	48,894	35,846	26,630	18,515	10,068	.....
Percentage of Gain	42	44	50	53	45	.....

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22 More M. A. M. A. Firms for Chicago Show

NEW YORK, Jan. 19—The Motor & Accessory Manufacturers' Assn. has added the following concerns to the list of exhibitors at the Chicago Automobile Show:

Air Device Co.....Chicago
F. A. Ames Co.....Owensboro, Ky.
Anderson Forge & Machine Co.....Detroit
Auto Pedal Pump Sales Corp.
456 Fourth Avenue, New York
Bay State Pump Co.....Boston
Carburetor Mantle Co., Inc.
1476 Broadway, New York
Copeman Laboratories, Inc.....Flint, Mich.
G. L. W. Spring Oiler Co....San Diego, Cal.
Gibraltar Jack Co..1902 Broadway, New York
Guarantee Liquid Measure Co.
Pittsburgh, Pa.
McCord Mfg. Co.....Detroit
Menominee Electric Products Co.
1756 Broadway, New York
Miller Transmission Co.
90 West Street, New York
New Era Spring & Specialty Co.
Grand Rapids, Mich.
Wm. E. Pratt Mfg. Co.....Chicago
Rajah Auto Supply Co....Bloomfield, N. J.
Rand Mfg. Co.....Haverhill, Mass.
Rex Mfg. Co.....Connersville, Ind.
Taft-Pierce Mfg. Co.....Woonsocket, R. I.
C. R. Wilson Body Co.....Detroit
Wire Wheel Corp. of America..Buffalo, N. Y.
Woodworth Mfg. Co....Niagara Falls, N. Y.

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Will Not Move Girl's Office

WASHINGTON, D. C., Jan. 21—The plans for moving the offices of Christian Girl and the Military Truck Production Board to the Union Depot Office Building has been abandoned. Mr. Girl and his organization will remain at 1421 Eye Street. J. G. Utz, supervisor of inspection and engineering of the board, has removed his offices, however, from Mr. Girl's division to the Union depot. The Military Truck Production Board which, as was recently stated in these columns, now includes the functions of engineering and maintenance as well as production of Liberty trucks, is now known as the Motor Transport Section of the office of the Quartermaster General. This entire section is headed by Mr. Girl as chairman.

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French Becomes a Lieutenant

INDIANAPOLIS, Jan. 22 — Lucius French, advertising manager of the National Motor Car & Vehicle Corp., Indianapolis, has resigned to accept a commission of first lieutenant in the United States Ordnance Department. He will be attached to the motor equipment section.

Australia Modifies Import Law

Extends Time for Shipment of Detached Bodies from U. S. Until March 31

NEW YORK, Jan. 23—The Australian government has made an additional ruling with regard to the shipment of automobile bodies from America to Australia and which ruling extends for a period of 3 months the time in which bodies can be shipped from America to Australia without being fitted on their chassis or accompanied by additional chassis.

The new ruling states that bodies may be shipped from America up to March 31, 1918, which is really a 3 months' extension. This information, given out by the Australian Department of Trades and Customs in this city is really the fourth step in the program with regard to prohibition of automobile bodies which started on Aug. 10.

Prohibition Proved Embarrassing

The absolute prohibition placed on the importation of bodies into Australia at that time proved embarrassing because body builders in Australia were not able to cope with the requirements and a famine of bodies was precipitated.

The ruling was modified so that a complete car was admitted, providing two additional chassis were imported at the same time. Now the final ruling extends the period of receiving bodies without any restrictions whatever, providing they are shipped from America prior to March 31.

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Double Aviation Appropriation

WASHINGTON, D. C., Jan. 21—Major-General George O. Squier of the Signal Corps and member of the Aircraft Production Board is asking Congress today for $1,032,294,260. This amount almost doubles the $640,000,000 already allotted for the Aviation program, and does not include $105,000,000 additional which is estimated for the needs of the Signal Corps.

Secret Progress Report

General Squier explained behind closed doors the progress already accomplished and gave the figures and technical details showing what it is expected this billion dollars asked for will accomplish. The Aircraft Board operating on a very efficient basis eliminates all red tape in its methods. It is spending an average of $2,000,000 a day and no contractor has ever to wait more than twenty-four hours for payment. Plans conceived in the morning are voted on at noon and put into operation before night. The need for the billion dollars is created by the fact that the money already allotted has for the most part already been converted into fighting material and into the accessories needed for the conquest of the air.

Men of the Industry

Changes in Personnel and Position

C. S. Thompson Joins Four-Wheel-Drive Co.

CLINTONVILLE, WIS., Jan. 21—C. S. Thompson, Chicago, has been appointed manager of foreign sales of the Four Wheel Drive Automobile Co., Clintonville, Wis., to fill the vacancy caused by the resignation of J. M. Homs, who has become associated with his brother in the exporting business in New York City.

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H. G. Ault has been named by the General Tire & Rubber Co., Akron, to head its reorganized sales department covering tire accessories and repair materials. Ault has been connected in a similar capacity with the Firestone Tire & Rubber Co.

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C. W. Whitston has joined the sales force of the Fulton Motor Truck Co., with headquarters in Chicago. Immediately after the Chicago show he will be assigned the position of district sales manager.

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E. G. Hosler, formerly connected with the Willys-Overland Co., Toledo, as district manager of the mid-western division, has purchased the Overland-Houston Co., Houston, and on Jan. 1 assumed the duties of president and general manager.

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Harry Cunningham has become associated with the engineering staff of the Maxwell Motor Co., in the war truck department. He was formerly head of the Cunningham Auto Sales Co., Michigan Maxwell distributer, and has passed examination for a major's commission in the non-flying section of the Aviation Corps.

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W. J. Drumpelman has been appointed assistant sales manager of the Hudson Motor Car Co., Detroit. He was formerly assistant general manager of the Elgin Motor Car Corp., and has been in the sales department of the Lozier, Oldsmobile and Chalmers companies.

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Frank J. Foley, formerly manager of the mining department of the Westinghouse & Electric Mfg. Co., has become associated with the Edison Storage Battery Co., Orange, N. J. He will manage the mining and traction department, with headquarters in Orange.

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Morton P. Leihy, branch manager of the Locomobile Co. of Missouri has been appointed branch manager of the Nordyke & Marmon Co., Kansas City, to succeed Major A. L. Ellwood, resigned to enter the army service as aviator.

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C. Floyd Greene has been appointed wholesale director of the E. A. Myers Co., Pittsburgh. He was formerly district manager of the Chalmers Motor Co.

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Nelson Hall has been appointed production engineer of the Fisher Electrical Works, Detroit, manufacturers of electrical starters for Ford cars.

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Franklin T. Chapman, formerly body engineer and assistant to the manager of the Olympian Motors Co., has been appointed assistant general sales manager of E. F. Houghton & Co., Pontiac.

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D. H. Wetzel, for the last 5 years sales manager of the Mott Wheel Works, Jackson, Mich., has resigned.

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Charles A. Swan, formerly superintendent of the Becker Steel Co. of America, has joined the sales organization of the Hess Steel Corp., Baltimore. He will represent the Hess company in Cleveland and Detroit territory.

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W. H. Knowles, who was formerly chief engineer of the Saxon Motor Car Co., has been appointed superintendent of Hale & Kilburn Co., Philadelphia.

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Shope Made Zenith Sales Manager

DETROIT, Jan. 21—V. I. Shope has been appointed sales and advertising manager of the Zenith Carburetor Co., to succeed A. H. Doolittle, who resigned recently. Shope was formerly New York branch manager of the company.

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DIVIDENDS DECLARED

The Fisher Body Corp. has declared a regular quarterly dividend of 1¾ per cent on the preferred stock, payable Feb. 1 to stock of record Jan. 21.

The Westinghouse Electric & Mfg. Co. has declared the regular quarterly dividend of 1¾ per cent, (87½ cents per share) on the common stock, payable Jan. 31 to stock of record Dec. 31.

The Stewart-Warner Speedometer Corp. has declared the usual quarterly dividend of 1½ per cent on the common stock, payable Feb. 25. Books close Jan. 30 to Feb. 20, inclusive.

A quarterly dividend of $1.25 a share has been declared on the common stock of the Pierce-Arrow Motor Car Co., payable Feb. 1 to stock of record Jan. 17.

The Kelsey Wheel Co. has declared a preferred quarterly dividend of $1.75 payable Feb. 1 to stockholders of record Jan. 21.

The Nash Motors Co. has declared a regular quarterly dividend of $1.75 a share on the preferred stock and an initial dividend of $6 a share on the common stock, payable Feb. 1 to stockholders of record Jan. 19.

The Curtiss Aeroplane & Motors Corp. has declared a semi-annual dividend of 3½ per cent on preferred stock, payable Jan. 15 to stock of record Jan. 2.

New Companies Formed

Latest additions to ranks of Automotive Industries

Star Co. to Make $750 One-Man Tractor

FINDLAY, OHIO, Jan. 21—The Star Tractor Co. has begun the erection of several buildings in which to construct the Star tractor, a $750 one-man machine. The company has been organized with a capital stock of $100,000, with some of Findlay's best known financiers. J. E. Bicknell is president of the corporation; C. A. Schubert, vice-president; C. E. Jordan, secretary; C. L. Casterline, trustee, and F. H. Gerdemann, engineer.

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BARABOO, WIS., Jan. 21—A. S. Lanich, who recently disposed of his garage and retail business, one of the first to be established in Baraboo, Wis., will engage in the manufacture of a line of garage specialties of his own invention, which he has been producing on a small scale for a year or more. The principal article will be an automatic opening and closing device for garage doors, which also is suitable for double-doors of shipping rooms, factories, etc. Several are now in operation in large Wisconsin garages. For the present contracts for casting and machining the parts will be made with commercial foundries until the business assumes sufficient size to make possible the establishment of a complete plant in Baraboo.

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MILWAUKEE, Jan. 21—The Texas Co., Houston, Tex., producer and refiner of petroleum products, has been granted a charter in Wisconsin and will open a branch in Milwaukee. The capital stock is $5,500,000 and the Wisconsin interest is given at $5,000.

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Chevrolet General Offices in New York

NEW YORK, Jan. 19—The Chevrolet Motor Co. has moved its general offices from Flint, Mich., to Broadway and Fifty-seventh Street, New York. The New York store will be located in the same building.

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Government Work for Haynes

KOKOMO, Jan. 18—The Haynes Automobile Co. expects a Government contract for the manufacture of 4000 motors and 4000 transmissions, entailing a cost of about $3,000,000. These orders would keep the company's plant in capacity operation for 6 months, and the production of pleasure cars probably would be curtailed temporarily, according to representatives of the company.

Detroit Shell Buys Springfield Body Plant

DETROIT, Jan. 22—The Detroit Shell Co. has purchased most of the assets of the Springfield Body Co., including buildings, land and all machinery except that used for wood working. The sale, which brought $600,000, does not include stock on hand, accounts in receiving or patents. The sale of patents on the Springfield body is pending, and patent litigation with the Fisher Body Corp., Detroit, has been successfully terminated. Barney F. Everett, trustee of the bankrupt company, states that the general creditors will doubtless receive 75 cents on the dollar. The Detroit Shell Co. is contemplating important additions to the Springfield plant.

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Hayes Wheel to Start Production

JACKSON, MICH., Jan. 21—C. B. Hayes has been elected president of the Hayes Wheel Co. The plants of the Jackson Automobile Co. and the Mutual Motors Co. here will be utilized and the company hopes to start production before the middle of February.

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Case Tractors for France

RACINE, WIS., Jan. 21—The J. I. Case Threshing Machine Co., Racine, Wis., has received an order from the French Government for 2000 gas-oil tractors with three-bottom plows, and began deliveries during the week. The 2000 machines are of the 10-20 type. A large number of tractors of a heavier and more powerful type also will be built for France. The Case company recently shipped a large order of tractors and separators to Italy.

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May Sell Metz Plant

WALTHAM, Jan. 19—The Metz Co. is planning to sell its plant to liquidate its debts. It will retain one part of the group of buildings in which it will carry on Government work. The matter has been under consideration for some time and a decision was reached a few days ago. The company has some 40 acres of very valuable land, and a lot of fine machinery which should bring good prices now with the demand for these things due to war work in New England.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

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Overland Starts Airplane Work in Elmira

ELMIRA, N. Y., Jan. 21—The Willys-Overland Co. is manufacturing patterns, dies and jigs, and is assembling airplane engines in its plant here. In its Elyria, Ohio, plant, connecting rods, crankshafts and miscellaneous parts are being made.

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National Wheels for Fisher Body Corp.

GENEVA, N. Y., Jan. 21—The National Wire Wheel Works, Inc., will furnish the new type Palmer airplane wheel to the Fisher Body Corp., Detroit. This wheel has been adopted by the Government for use on heavy airplanes.

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American Forging Quadruples Output

PONTIAC, MICH., Jan. 21—The American Forging & Socket Co. has quadrupled its output in the last 2 years. The socket department has increased its capacity to 1000 sets a day and employs 150 men.

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Olson Truck Going Overland

DETROIT, Jan. 22—In spite of the inclement weather, the Swedish Crucible Steel Co. started one of its Olson 2-ton truck units overland for New York. Two and one-half days were required to reach Cleveland. A full load is being carried.

$20,000,000 Contract for Weidely Motors Co.

INDIANAPOLIS, Jan. 21—The contract of the Weidely Motors Co. for the manufacture of $3,000,000 worth of tractor engines for the Cleveland Tractor Co., Cleveland, has been increased to an order of $20,000,000. To meet the increased expense the Weidley company has issued $400,000 in additional preferred stock, making the total amount $500,000. The company expects to construct new buildings at a cost of $150,000. The program calls for 15,000 motors in 1918, 25,000 in 1919 and 30,000 in 1920. The present output is from 15 to 20 daily.

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Marmon Enlarging Plant

INDIANAPOLIS, Jan. 21—The Nordyke & Marmon Co. is completing plans for enlarging its plant. Approximately $400,000 will be expended for the new building and $1,500,000 in machinery. The company is working on a government contract for airplane engines.

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New Clubhouse of the Engineers' Club of Dayton

(*Continued from page* 223)

lantern booth. This booth is entirely concealed at the rear of the auditorium and is provided with all modern appliances and conveniences.

Four fireproof stairways lead from the auditorium to the ground level which, together with a fireproof building offer the best possible protection to the occupants.

On the third floor are two attractive bedrooms, cheerfully decorated and furnished, which have bath and toilet facilities conveniently located.

A suburban locker room is also provided on this floor for the convenience of those members living some distance from the club building. The whole building is provided with large steel casement windows, affording ample light at all times.

Fuel for Automotive Apparatus

(*Continued from page* 228)

The utilizing in automobile engines of a type of fuel that contains the combined gasoline and kerosene fractions of crude petroleum would certainly double the available supply, and even if all the other agencies working to this end failed the automotive engineers themselves would postpone for a long time the fateful day when their industry will be handicapped by not having available the material to feed engines after they have been produced.

Author's Conclusion

The present paper has developed along rather heterogeneous lines but can be summarized rather simply. The present fuel situation, in spite of the fact that gasoline is high in price and relatively low in volatility, is good. This will be appreciated more fully if war conditions add one more inconvenience to the already lengthy list that the country is experiencing. The newer types of gasolines are not inherently worse than the old; the price is not out of proportion to the price of crude petroleum, and the supply is abundant and well distributed.

In the future it appears that oil producers must secure more crude petroleum and refiners must get greater yields of volatile products out of oil treated. Designers must work toward higher standards of fuel economy and must strive to develop engines that will handle fuels of lower average volatility than the present type. A certain increase in supply of fuel may be counted on from the coal distillation industry and eventually the supply may be derived either from oil shale or from fermentation industries.

In closing it is desired to remind the members of the Society of Automotive Engineers that the present paper makes no pretense of being a last word on the important subject with which it deals.

The various phases of the fuel situation could be discussed at almost infinite length, and it is realized that even the few problems mentioned in this paper have not been given the detailed consideration they deserve. It is hoped, however, that the attention of the engineers of the Society may have been called to some other problems that they can profitably study.

New Process May Triple Gasoline

NEW YORK, Jan. 21—A new process, which, it is stated, will triple the quantity of gasoline obtainable from crude oil, is said to have been perfected by Dr. A. H. Ramage, who is a member of the American Electro-Chemical Society. It is stated that a company has been formed in Detroit to manufacture and market gasolene produced under this new process, and that Christian Girl, head of the Standard Parts Co., Cleveland, is interested in the company, which also includes A. H. Goss, a Detroit capitalist; E. W. Farr, a Cleveland capitalist; S. A. Fletcher, an Indianapolis banker; H. B. Smith, a Bay City, Mich., banker; F. C. Finkenstaedt, Bay City, formerly head of the National Cycle Co.; H. B. Barhart, head of the White Star Oil Co., Detroit, and A. E. Leopold, a Chicago capitalist. It is stated that the process differs from the Burton process and does not employ the cracking principle. Instead the oil is claimed to be chemically charged as it passes through the stills with the result that the yield of gasolene is tripled. It is said that the owners of the process have offered it to the Government.

Gillette Tires for New York Cars

EAU CLAIRE, WIS., Jan. 21—The Gillette Rubber Co. has been awarded the contract for furnishing the city of New York with all pneumatic tires required for municipally-owned vehicles during 1918. The plant has now reached a daily production of 350 casings and 400 tubes and the output is being increased as rapidly as possible. Reclaimed and waste material is being worked up into rubber heels and other commercial rubber goods, for which the company has gained an outlet for its entire production for some time ahead.

Calendar

ASSOCIATIONS

Feb. 4-7 — St. Louis, American Road Builders' Assn. Convention.

April 18-20 — Cincinnati, Fifth National Foreign Trade Convention.

GENERAL

Jan. 22-24—Montreal, Can., Convention of All Men Interested in the Automobile Industry in Eastern Canada.

Jan. 29-31—Chicago, Annual Convention, Garage Owners' Assn. of Ill., Green Room, Congress Hotel.

SHOWS

Jan. 16-25 — Milwaukee, Wis., Milwaukee Automobile Dealers, Inc., Auditorium. (First 7 days, passenger cars; last 3 days, commercial cars.) Bart J. Huddle, Mgr.

Jan. 18-24 — Des Moines, Ia., Ninth Annual Passenger Car and Second Annual Truck, Des Moines Automobile Dealers' Assn., Coliseum. C. G. Van Vliet and Dean Schooler, Mgrs.

Jan. 19-26—Detroit Automobile Dealers' Assn., Overland Bldg. H. H. Shuart, Mgr.

Jan. 19-26 — New York Motor Boat Show, Grand Central Palace, National Assn. of Engine and Boat Manufacturers.

Jan. 19-27 — Cleveland, Seventeenth Annual, Cleveland Automobile Show Co., Wigmore Coliseum. Fred. H. Caley, Mgr.

Jan. 19-26 — Montreal, Can., Montreal Automobile Trade Assn., Ltd., Almy Bldg. T. C. Kirby, Mgr.

Jan. 21-26—Scranton, Pa., Scranton Motor Trades Assn., Armory. Hugh B Andrews, Mgr.

Jan. 21-26 — Wilmington, Del., Hotel Du Pont.

Jan. 21-26—Buffalo, N. Y., Buffalo Automobile Dealers' Assn., Broadway Auditorium.

Jan. 21-26—Richmond, Va., Richmond Automobile Dealers' Association, First Regimental Armory. Henry B. Marks, Mgr.

Jan. 22-26 — Mifflintown, Pa., Automobile Trade Assn. Valley Stream Auditorium.

Jan. 22-26—Baltimore, Md., Baltimore Automobile Dealers' Assn. and Automobile Club of Maryland. 5th Regiment Armory.

Jan. 22-26 — Oklahoma City, Okla., Oklahoma City Automobile Dealers' Assn., 701 No. Broadway. Roy H. Haun, Mgr.

Jan. 23-28—Allentown, Pa., Lehigh Auto Trade Assn., Traylor Motor Co.'s Garage. P. W. Leisering. Publicity Mgr.

Jan. 26-Feb. 2 — Chicago National Show, Coliseum and Armory, National Automobile Chamber of Commerce.

Jan. 26-Feb. 2—Chicago, Salon, Elizabethan Room of Congress Hotel.

Jan. 26-Feb. 2—Bridgeton, N. J., Bridgeton Auto Dealers' Assn. O. P. Riley, Sec.

Jan. 26-Feb. 2—Harrisburg, Pa., Harrisburg Motor Dealers' Assn., Emerson-Brantingham Bldg. J. Clyde Myton, Mgr.

Jan. 26-Feb. 3—York, Pa., York County Auto. Dealers' Assn., Tabernacle. T. F. Pfeiffer, Sec.

Jan. 28-Feb. 2—Manchester, N. H., Academy. Couture Bros.

February — Greensburg, Pa., Westmoreland Automobile Dealers' Association.

Feb. 5-9 — Twin City Auto., Truck, Tractor and Industrial Exposition, Overland Bldg. Minneapolis Auto. Trade Assn. Walter B. Wilmot, Mgr.

Feb. 5-9 — Kalamazoo, Mich., Kalamazoo Automobile Dealers' Assn., Armory.

Feb. 5-9—Binghamton, N. Y., Binghamton Automobile Dealers' Assn., Kalurah Temple. William M. McNulty, Mgr.

February — Peoria, Ill., Peoria Auto and Accessories Dealers' Assn. W. O. Ireland, Mgr.

Feb. 6-9—Lancaster, Pa., Automobile Track Assn., Fidelity Bldg. R. W. Shreiner, Mgr.

Feb. 7-13—Portland, Ore., Ninth Annual Dealers' Motor Car Assn., Auditorium. M. O. Wilkins, Mgr.

Feb. 9-16 — Bronx, N. Y., 2d Battery Armory, Bronx Automobile Dealers' Assn D. J. Barrett, Mgr.

Feb. 11-17 — Toledo, Terminal Auditorium. Toledo Auto Show Co.

Feb. 11-16—St. Louis, Mo., St. Louis Auto Mfrs. & Dealers' Assn. Robert E. Lee, Mgr.

Feb. 11-16 — Kansas City, Mo., Kansas City Motor Car Dealers' Assn., Convention Hall. E. E. Peake, Mgr.

Feb. 11-16—Kansas City, Mo., Third Annual National Tractor Show.

Feb. 13-16 — Ft. Wayne, Ind., Automobile Trade Assn., Concordia Gymnasium.

Feb. 16-23—Albany, N. Y., Albany Auto Dealers' Assn. State Armory.

Feb. 16-24—San Francisco, Cal., San Francisco Dealers' Assn., Exposition Auditorium. G. A. Wahlgreen, Mgr.

Feb. 18-23—Syracuse, N. Y., Syracuse, Automobile Dealers' Assn., State Armory. Harry T. Gardner, Mgr.

Feb. 18-23 — Nashville, Tenn., Nashville Auto Trade Assn., Hippodrome. Henry B. Marks, Mgr.

Feb. 18-23—Grand Rapids, Mich., Automobile Business Assn., Klingman Building. Ernest T. Conlon, Mgr.

Feb. 18-23—Newark, N. J., N. J. Auto Exhibition, Co. G. First Regiment Armory. Claude E. Holgate, Mgr.

Feb. 18-23 — Springfield, Ohio, Springfield Auto Trades Assn., Memorial Hall. C. S. Burke, Mgr.

Feb. 18-23 — Waterbury, Conn., United Shows Co.

Feb. 18-23—Duluth, Minn., Duluth Automobile Trade Association. John J. Lane, Mgr.

Feb. 18-23 — Pittsfield, Mass. State Guard, State Armory. James J. Callaghan, Mgr.

Feb. 18-27—So. Bethlehem, Pa., Fourth Annual (cars 18-23; trucks 25-27), Coliseum. J. L. Elliott, Mgr.

Feb. 20-23—Quincy, Ill., First Annual, Armory. L. B. Bartlett, Mgr.

Feb. 23-Mar. 2—Brooklyn, N. Y., Brooklyn Motor Vehicle Dealers' Assn., 23d Regiment Armory. I. C. Kirkham, Mgr. Passenger cars Feb. 23-Mar. 2; Trucks Mar. 5-9.

Feb. 23-Mar. 2—Omaha, Neb., Omaha Auto. Trade Assn. Auditorium. Clarke G. Powell, Mgr.

Feb. 25 - Mar. 2—Indianapolis, Indianapolis Automobile Trade Assn., Diamond Chain Work Bldg. John B. Orman, Mgr.

Feb. 25-Mar. 2—Muskegon, Mich. Second Annual Merrill Auditorium. John C. Fowler, Mgr.

Feb. 25-Mar. 2 — Bridgeport, Conn., Fourth Regiment Conn. Home Guard, State Armory and Casino. B. R. Steiber, Mgr.

Feb. 27-Mar. 2—Columbus, O. Auto Exhibitors Co. W. W. Freeman, Mgr.

Feb. 27-Mar. 6—Boston, Mass., Salon, Boston Automobile Dealers' Assn., Copley Plaza Hotel. Chester I. Campbell, Mgr.

Mar. 1-15—Lyons, France, Third Sample Fair.

Mar. 2-9—Boston, Mass., Boston Auto. Dealers' Assn., Mechanics' Bldg. Chester I. Campbell, Mgr.

Mar. 2-9—Pittsburgh, Pa., Automobile Dealers' Assn. of Pittsburgh, Motor Square Garden. John J. Bell, Mgr.

Mar. 4-9—Utica, N. Y., Utica Motor Dealers' Association, Inc., State Armory.

Mar. 6-9—Clinton, Ia., Clinton Automobile Dealers' Assn., Coliseum.

Mar. 6-9—Watertown, N. Y., Automobile Dealers, Inc., State Armory. Arthur E. Sherwood, Mgr.

Mar. 6-9—St. Joseph, Mo., St. Joseph Automobile Dealers' Assn., Auditorium. John Albus, Mgr.

Mar. 8-11 — Green Bay, Wis., Brown County Automobile Trade Assn.

Mar. 12-15—Fargo, N. D., Gate City Auto. Show Co., Auditorium. J. W. Murphy, Mgr.

Mar. 15-20—Great Falls, Mont., Montana Automobile Distributors' Association, Lexington Garage. A. J. Breitenstein, Mgr.

Mar. 19-24—San Francisco, Cal., Motor Truck Dealers of San Francisco, Auditorium. Ivan R. Gates, Mgr.

Mar. 11-16—Cedar Rapids, Ia., Cedar Rapids Auto Trade Assn., Auditorium.

Mar. 20-22—Houlton, Me., Second Annual, Houlton, Motor Car Dealers' Assn., Bangor St. Exhibition Hall. J. D. Luth, Mgr.

Mar. 20-23 — Holdredge, Neb., Second Annual of Southwest Nebraska.

Mar. 20-23 — Trenton, N. J., Trenton Auto Trade Assn. Second Regiment Armory. John L. Brock, Mgr.

Mar. 30-Apr. 6—Hartford, Conn., Eleventh Annual, Hartford Automobile Dealers' Assn., Inc. State Armory. B. F. Smith, Mgr.

Apr. 6-13—Red Bank, N. J., Monmouth County Auto. Dealers' Assn., Armory. E. C. Von Kattengell, Mgr.

Apr. 9-13—Stockton, Cal., Third Annual San Joaquin Auto Trade Assn. Samuel S. Cohn, Mgr.

Apr. 17-20—Calumet, Mich., Upper Peninsular Show, Copper County Automobile Dealers & Garage Owners' Assn., Coliseum.

Sept 23-28 — Chicago, National Accessory Show for Fords, Coliseum.

S. A. E.

Feb. 1 — Chicago, War Dinner during Winter Meeting.

ENGINEERING

American Society of Heating and Ventilating Engineers.
Mining and Metallurgical Society of America.